www.conferenceworld.in

INTERNATIONAL CONFERENCE ON MULTIDISCIPLINARY APPROACHES IN ENGINEERING, MANAGEMENT & SCIENCE

MAEMS-18

SRI S.R.N.M. COLLEGE
SATTUR

SRI S RAMASAMY NAIDU MEMORIAL COLLEGE,
SATTUR , VIRUDHUNAGAR DISTRICT, TAMIL NADU,
INDIA

14TH DECEMBER 2018

ISBN: 978-93-87793-62-0

INTERNATIONAL CONFERENCE ON MULTIDISCIPLINARY APPROACHES IN ENGINEERING, MANAGEMENT & SCIENCE

MAEMS-18

Editors

DR. S. GANESHRAM

DR. P. K. ARUNESH

DR. A.K SHARMA

Publish By:

A.R. Research Publication

Preface

Conference World and AR Research Publication is fast growing group of academicians in Engineering, Sciences and Management. AR Research Publication is also known for fast reply and zero error work. Conference world has organized a various conferences at renowned places namely Delhi University; New Delhi, Jawaharlal Nehru University; New Delhi, PHD Chamber of Commerce and Industry New Delhi, YMCA New Delhi, India International Centre, New Delhi , Sri Venkateswara college of Engineering and Technology, Andhra Pradesh, Dhananjay Mahadik Group of Institutions (BIMAT), Shivaji University, Maharashtra, International Conference Centre , Goa, Vedant Engineering Kota and many more places across the country.

We are very pleased to introduce the proceedings of the *International Conference on Multidisciplinary approaches in Engineering, Management & Science (MAEMS-18).* As for previous conferences, the theme was the link between the information provided by conference world and the use made of this information in assessing structural integrity. These were the issues addressed by the papers presented at the conference. The level of interest in the subject matter of the conference was maintained from previous events

Total 275 papers were received for the conference and 30 papers were shortlisted by the committee.

Papers were well represented in the conference to arouse a high level of international interest. Three countries were represented in the final program from Europe, North America and Asia. In the event, the conference was highly successful. The presented papers maintained the high promise suggested by the written abstracts and the program was chaired in a professional and efficient way by the session chairmen who were selected for their international standing in the subject. The number of delegates was also highly gratifying, showing the high level of international interest in the subject. This is also indicated by the large number of countries, 04 represented by the delegates. This Proceeding provides the permanent record of what was presented. They indicate the state of development at the time of writing of all aspects of this important topic and will be invaluable to all workers in the field for that reason. Finally, it is appropriate that we record our thanks to our fellow members of the Technical Organizing Committee for encouraging participation from those areas. We are also indebted to those who served as chairmen, without their support, the conference could not have been the success that it was. We also acknowledge the authors themselves, without whose expert input there would have been no conference. Their efforts made a great contribution to its success.

Proceeding of the conference has been published with **ISBN: 978-93-87793-62-0**

Sri S Ramasamy Naidu Memorial College, Sattur , Virudhunagar District, Tamil Nadu, India we have got excellent remark for all branches are striving hard to nurture students so as to match global standards of an engineer through various innovative curricular activities, such as profuse result is the hosting of a *International Conference on Multidisciplinary approaches in Engineering, Management & Science (MAEMS-18)* held **on 14th December 2018**

About the Institution

" *Education is the kindling of a flame, not the filling of a vessel* " ~ *Socrates*

Sri S.Ramasamy Naidu, familiarly known as "SR" was a dedicated educationalist and freedom fighter. His realization that political freedom will be of no value unless there is freedom from illiteracy led him to work tirelessly for the great cause of education. Thanks to his keen interest and initiative today, this part of Tamilnadu is blessed with a number of educational institutions.

Four decades ago, some great philanthropists of this region founded our College in memory of this visionary leader, in order to realize his noble ambition. It was incepted at Nagalapuram village in 1970 with Thiru.V.Venugopala Krishnasamy Naidu as its Founder President. The Mission of the College was to serve the interests of the rural poor, help them have the benefit of excellent education and find employment, and thereby ameliorate their lifestyles.

In 1972, the College was shifted to Sattur. The College became a University-affiliated first-grade institute offering a degree course in B.A. Branch-I-History. Then the urgent need for a more spacious institution was deeply felt. Hence a forty-eight-acre site was purchased. Thanks to the generosity of its countless benefactors over the years, it is possible for the College to have a number of magnificent buildings now. In this regard, the College gratefully remembers the munificence of a great philanthropist, Late Sri.Sathu.T.Ramasamy Naicker, the founder of Sri Jaya Vilas (P) Ltd., Aruppukottai.

At present the College is offering 12 Undergraduate courses, 9 Postgraduate courses, 4 Diploma courses, 3 M.Phil. Courses and 2 Ph.D. programmes.

The National Assessment and Accreditation Council (NAAC), an autonomous body of the UGC, reaccredited our college with 'A 'Grade in 2012.

The UGC has granted the Autonomous Status to the College from the academic year 2010-2011 for offering UG, PG and Research Programmes.

Since its inception, this institution of higher learning has been fulfilling the educational needs of the people of this area in a commendable way.

Hon. Chief Patron

Dr. T.R.Dhinakaran,
Secretary, Sri S.R.N.M College, Sattur, India

Patron

Dr. S.Ganeshram, Principal

Convener

Dr. P.K. Arunesh Dean Academic & Associate professor of Computer Science

Co-Conveners

Dr. S.Brintha Uma Maheswari	**Asso.Prof. (History)**
Dr. B.Ajantha	**Asst.Prof. (English)**
Dr. A.Ranichithra	**Asst.Prof. (Computer Science)**

Organizing Secretaries

Mr. A.Rajeshkanna	**Asst.Prof. (Computer Science)**
Dr. A. Muthumani	**Asst.Prof. (Commerce)**
Ms. U.Fathima Farzana	**Asst.Prof. (English)**

Co-ordinators

Dr. R.Revathi	**Asst.Prof. (History)**
Dr. M.Kavitha	**Asst.Prof. (Tamil)**
Dr. A.Mercy Rani	**Asst.Prof. (Computer Applications)**
Ms. V. Preetha	**Asst.Prof. (Computer Applications)**
Ms. V.Murugalakhsmi	**Asst.Prof. (English)**

Organizing committee

Dr. V.Kanagavel	**Head & Asst.Prof. (Commerce)**
Dr. T.Kavitha	**Asst.Prof. (Chemistry)**
Dr. B.Ravichandran	**Asst.Prof. (Zoology)**
Ms. R.Anitha	**Asst.Prof. (Physics)**
Mr. R.Sripathy	**Asst.Prof. (Computer Applications)**
Ms. M.Thilagam	**Asst.Prof. (Computer Applications)**
Mr. B. Srinivasa Ragavan	**Asst.Prof. (Computer Science)**
Ms. S.Maheswari	**Asst.Prof. (Computer Science)**

National Advisory Board

Dr S.Kiran
Assistant Professor, Y.S.R. Engineering College of Yogi Vemana University, Porattur, A.P.
Dr. Mohammad Abdul Hameed,
Assistant Professor, Dept of Computer Science and Engineering, Osmania University, Hydrabad.

International Advisory Board

Dr Aeila Falahati

University Putra Malaysia, Serdang, Malaysia

Dr. Ajay Singh

University of Hail, Hail, Kingdom of Saudi Arabia

Dr P. Corell

REU Program Director, Jackson State University Jackson, USA

Dr. D. Jone Stanley

M.S., M. Phil., Ph.D. , Texas A&M University, USA

Samer Said Sayed Radwan

Faculty of Applied Arts, Helwan University, Egypt

Dr. Abd El-Aleem Saad Soliman Desoky
Sohag University, Egypt
Prof. Dr. Amer A. Taqa
DBS Dept. College of Dentistry, University of Mosul, Iraq
Mehdi Gheisari
Islamic Azad University, ShamsiPour College, Bahonar College
Protap Mollick , Researcher,
American International University - Bangladesh
Department of Computer Science and Engineering.
Dr. Eng. Magdy Shayboub A. Mahmoud.
Assistant Professor of Computer Science Department.
Faculty of Computers and Informatics. Suez Canal University,Ismailia, Egypt .
Dr. Elsanosy M. Elamin
Assist. Pro. and Head Department of Electrical Engineering,
University of Kordofan. Faculty of Engineering. Elobeid, Sudan
Dr. Jaiprakash Narain Dwivedi
Research Associate, Kyushu Institute of Technology, Japan

Principal's Message

Education is the manifestation of the perfection already in man.

—Swami Vivekananda

Warm and Happy Greetings to all. I am immensely happy that faculties of our college are systematizing an International Conference MAEMS-18 on **"International Conference on Multidisciplinary approaches in Engineering, Management & Science"** with a collection of various technical papers in the proceedings.

Under the able guidance of our management, MAEMS continues to march on the way to success with confidence and pride. The sharp, clear sighted vision and precise decision making powers of our management have benefited our college to stay competitive.

The team of accomplished and resourceful professors groom and guide young scholars and energetic students to the best of their capacity. They work most diligently towards synergizing current trends in multi-disciplinary subjects to promote all round professional competence.

I also congratulate the convener and his eminent team, the participants from our state and other states for their efforts in organizing this conference and wish the conference all success.

Convener's Message

"Knowledge is power, and getting one you get the other. By knowledge you can even banish the material world"

—Swami Vivekananda

The fields of engineering, science, and technology are changing very fast. Engineering, science, humanities and management are becoming increasingly inter and multi disciplinary which paves the way to organize an International Conference **"International Conference on Multidisciplinary**

approaches in Engineering, Management & Science" - MAEMS-18 in collaboration with Conference World.

This conference is a unique system of edification for creating dynamic leaders in the corporate sector, entrepreneurs, academicians, researchers and professionals who contribute to the development of society and nation at large. It provides a podium for the participants to realize their dreams, hone their cognition, sharpen their competence and carve out a wholesome personality.

This conference includes an exciting collection of contributions resulting from a successful call for papers. The selected papers have been divided into thematic areas, which highlight the current focus of application-specific systems and research activities. In response to the call for papers, more than 150 submissions have been received. All the submissions were subjected to a rigorous review by the members of the program committee and external editors. After an intense scrutiny of the reviews, we are pleased to present a high quality technical session with 70 papers for presentation at the conference. They represent the current state-of-the-art multi-disciplinary fields of research.

I must thank all the contributors, reviewers and experts for their unconditional support in organizing this conference.

Published by

AR Research Publication,

3/186 Santpura Govindpuri Modinagar- 201201. Dist: Ghaziabad (India)

International Conference on Recent Trends in Engineering Science, Humanities and Management (MASHS-2018) (Vol-1) ISBN: **978-93-87793-62-0**

Managing Director: Gauri Sharma

Senior Researcher—Product Development: Ms. Pratima Singh
Head—Production (Higher Education and Professional): Satinder Kulkarni

International Conference on Multidisciplinary approaches in Engineering, Management & Science
Sri S.Ramasamy Naidu Memorial College, Sattur, Tamil Nadu, India (MAEMS-18)
14th December 2018 www.conferenceworld.in ISBN:978-93-87793-62-0

A Review on Soil Stabilization Comparing Traditional and Non-Traditional Additives

Pallavi A. Padalkar1, Dadasaheb O. Bhavar2, Tejashri A. Kulkarni3

1(Dept. of Civil Engineering Guru Gobind Singh College of Engineering & Research Centre Nashik)
2(Dept. of Civil Engineering Guru Gobind Singh College of Engineering & Research Centre Nashik)
3(Dept. of Civil Engineering Guru Gobind Singh College of Engineering & Research Centre Nashik)

ABSTRACT:

The Infrastructure is a major part that enhances overall development of the Indian financial system. Fast emergent population needs new roads bigger cities and industrialization to produce source of revenue, stabilization of soil becomes necessary as it improves soil properties to withstand the loads from infrastructure. This is a review paper on soil stabilization focusing on comparison between traditional and non-traditional additive used in soil stabilization. Use of non-traditional additive such as tire, jute, fibres etc. not only improves soil properties but also solves the problem of waste clearance.

Keywords- CBR, infrastructure, MDD, OMC,RHA,stabilization,and UCS

I. INTRODUCTION

Probing for the best soil stabilizers to conquer problems occur by the soft soils are still being the major concern, not only to achieve the required soil engineering properties but also by taking into consideration the cost and the effect to the environment. The purpose of this paper was to review the techniques and compare them for soil stabilization based on experimental studies. Investigation on various materials had been studied in order to estimate their effectiveness as soil stabilizer, which involved the use of additive, fly ash geopolymeric binder, various ashes and cementitiousbinders. Thesematerials were discussed in this paper and their effectiveness for stabilizing soft soils were observed from the studied results,only in term of strength, basedon unconfined compressive strength (UCS) test and California Bearing Ratio (CBR) test that had been conducted.

Researchers are motivated to create new technologies and methods to improve the techniques that are being used to utilize the resources for the sustainability of the materials in the long run. Thus it becomes necessary to make use of such techniques to make the best use of resources. Civil engineering aspect of proper utilization includes

Paper Sr. No - 2

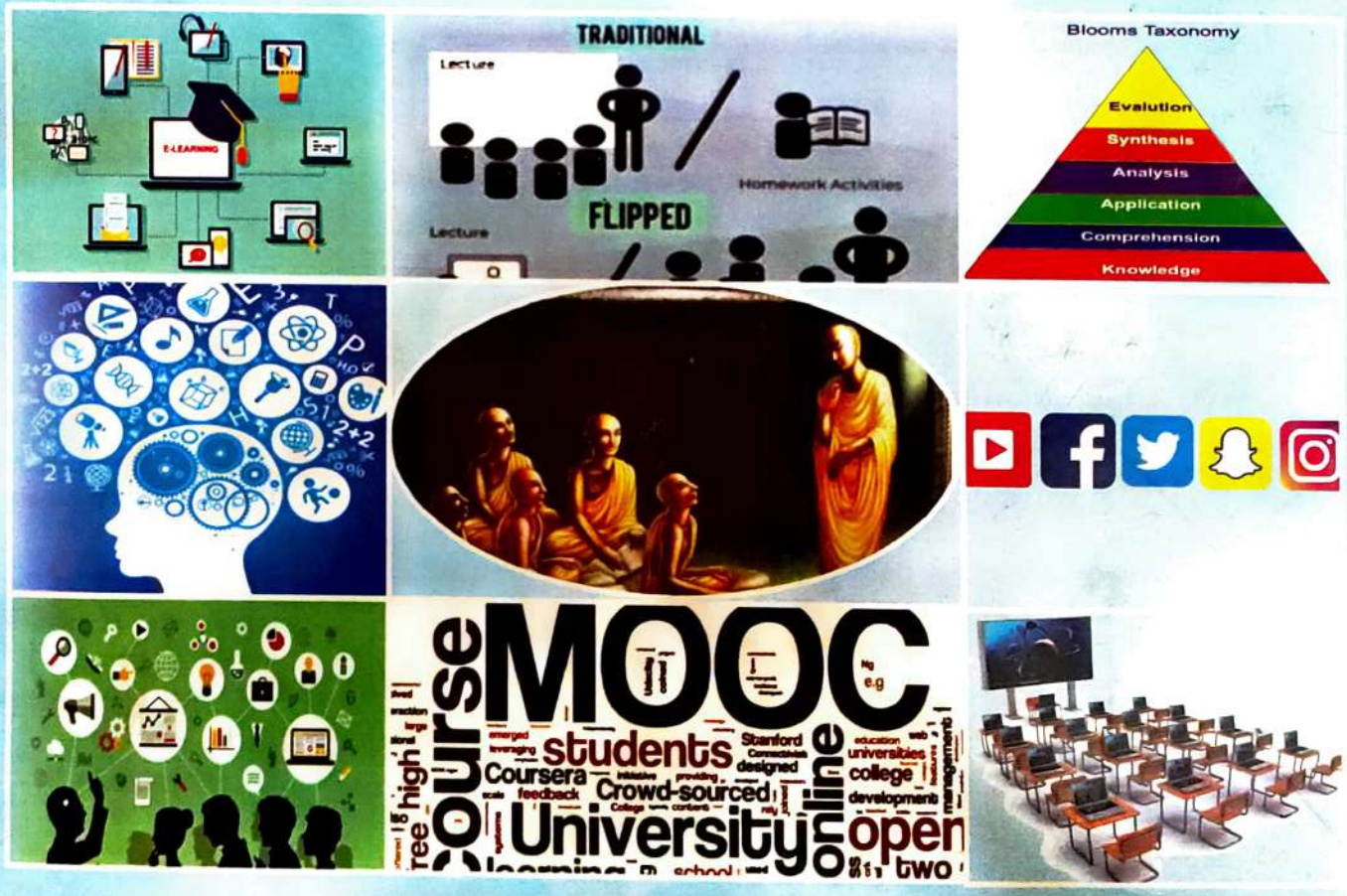
ISBN : 978-93-88441-93-3

NATIONAL CONFERENCE ON

Exploring New Dimensions in Teaching-Learning for Quality Education

8th - 9th June, 2019

Under Aegis of
All India Council for Technical Education, New Delhi



In Association with
Engineering Education Foundation

Organized By
K. K. Wagh Institute of Engineering Education and Research, Nashik (Maharashtra)

Hirabai Haridas Vidyanagari, Amrutdham, Panchvati, Nashik - 422003
Website: https://engg.kkwagh.edu.in

Teaching Learning Related to Engineering Education – A Review

Pallavi A. Padalkar[1]

[1]Guru Gobind Singh College of Engineering and Research Centre, Nashik.
padalkar.pallavi@gmail.com

Track No: 1

Track Name: Different Dimensions of Teaching Learning.

Abstract: In India Engineering education has been facing substantial challenges in regard to good quality teaching and knowledge deployment. This has given rise to the need of new teaching methods and learning techniques which must be developed in the field. Teaching being considered as a complex activity. The present review and study showcases on the concept of good teaching practices and methodologies affecting performance pattern of students in higher education with specifically related to engineering stream. The field of engineering being a continuously evolving stream, demands an innovation in the teaching and learning methodology, therefore, the review is anticipated to distinguish the factors which can be used for the evaluation of the students and the good teaching practices. The present study focuses on the latest innovative teaching methods in engineering education and recognizes the important factors influencing the same. Today's generation being the Google generation needs to be tackled very carefully. To provide engineering education to such students is the challenge in front of the tutors, which can only be dealt using new techniques and teaching methods.

Keywords: evaluation, Google generation, innovative, learning techniques, teaching methodology

5. Introduction

The undergraduate (UG) engineering students graduate from academic institutes with knowledge and information that associates their computational proficiency to engineering and technology principles, processes and practice. However, there appears to be a scarcity of evidence to suggest that UG students receive sufficient instructions throughout their curriculum and studies. This results in a need of different approaches of educating the undergraduate engineers. When it comes to training methods and a change in teaching methods, it's important to know the different ways in which people learn and retain information. Teaching methods should be adjusted to the different types of learners to ensure they have the best experience. According to Tech News, the different learning styles varies, a typical classroom will contain 20% Visual Learners, 25% auditory learners, 15% kinaesthetic learner and the remaining 30% consisting of students with mixed learning styles. This is an interesting statistic that supports that learning methods should cater to all types of learners.[5]

A. TYPES OF LEARNERS

Visual learners – These learners prefer to see information and to visualize the relation between the ideas. Such learners like referring to diagrams, charts, or graphs. These learners generally like to colour code information and translate information to visual data for better understanding and memorization.[1]

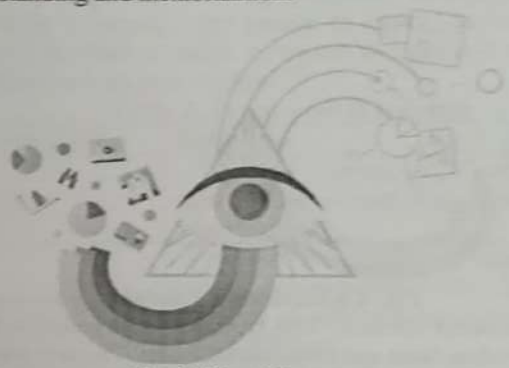


Fig. 1 Visual Learners

Auditory learners – They choose to hear information rather than reading it or seeing it displayed visually. They tend to be linear thinking and may repeat information several times to remember what they had just learned.[6,7]

Fig. 2 Auditory Learners

Reading / Writing learners – Reading and writing being one of the ancient methods of learning, is the best method of interacting with text is more powerful than that of hearing or seeing images.[6]

Proceedings of the

International Conference on Research Challenges to Multi Disciplinary Innovations

ICRCMI-2021

Organized by

ESTD. : 2013

Guru Gobind Singh College of Engineering and Research Center , Nasik

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2021

Volume 1, Issue 1,
Pages 0001-0344 (2021)

ISBN: 978-81-954237-0-5

The Proceedings of the International Conference on Research Challenges to Multidisciplinary Innovations (ICRCMI-2021) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically, the proceeding covers various technical reports in the fields of engineering and technology.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

Chief Editor:

Permindur Singh
Chief Executive Officer
Guru Gobind Singh Foundation, Nashik

Executive Editor:

Dr. Shyamkumar D. Kalpande
Professor, Department of Mechanical Engineering
Guru Gobind Singh College of Engineering and Research Centre, Nashik

Guru Gobind Singh Foundations

Guru Gobind Singh College of Engineering and Research Centre, Nashik

International Conference on

Research Challenges to Multi Disciplinary Innovation

Index

Progressive Collapse of Through Type Steel Truss Bridge

[1]D. S. Desale , [2]P. B. Shinde , [3]C. S. Kankariya

[1,2,3]*Asst. Prof. , Dept. of Civil Engg.,*
Guru Gobind Singh College of Engineering & Research Centre,
Nashik,India.

Abstract: *Progressive collapse is a failure of structure followed by local failure of any structural element in it. A condition in which local failure in structure caused by sudden change in loads, affects major portion of structure. The critical element is the one whose failure promotes failure of a structure as a whole. By identifying such an element, progressive collapse of a structure can be avoided by providing extra strength & special attention while design. This article presents the effect of members of through type steel truss bridge after removing members one by one in it. The primary objective of this research is to study the behavior of through type steel truss bridge using SAP2000. The secondary objective is to find out most critical section in the through type steel truss bridge after analyzing in SAP2000 V.20.*

Key words: Progressive collapse, SAP2000, Alternate load path method, Through Type Bridge.

I. INTRODUCTION

Progressive collapse has been defined as "the widespread propagation of failure following damage to a relatively small portion of the structure" (Breen 1975). A situation in which a localized failure in a structure, caused by an abnormal load triggers a cascade of failure affecting a major portion of the structure and total collapse [2]. Several buildings and steel bridges have collapsed in this fashion in recent years and the possibility of progressive collapse is a source of continuing concern. Several alternative methods to deal with the problem of design for the prevention of progressive collapse are reviewed. A computer analysis program capable of tracing the behavior of steel framed structures through collapse is analyzed in this project using SAP 2000[13].

Further progressive collapse can be defined as complete failure of structure due to damage of relative small portion of structure. A condition in which local failure in structure caused by sudden change in loads resulting into damage to major portion of structure. In every structure there is one or more than one critical element that is subjected to maximum load, if due to some inconstancy like excessive load, abnormal load, blast, terrorist attacks, disintegration of material will cause failure of that particular member. Due to which the whole structure is likely to fail in the progressive style. Though one of the preventive methods for this is to increase cross section of the critical member, it is not effective way to prevent failure.

Therefore the focus is to reduce the impact of such critical member on the structure by proper analysis & giving suitable recommendations for that. Using different software's the analysis of structure becomes easier & gives effective results. This research aims towards study and behaviour of through type steel truss bridge using SAP200. Further to identify most critical section in the bridge, so that after adopting suitable provisions for critical section progressive collapse of structure can be avoided.

II. BRIDGE GEOMETRY

The geometry of through type steel truss bridge is collected by visiting Central Railway Workshop, Manmad, Maharashtra. The geometry is described below-

Table 1- Geometry of Bridge

Specification	Description
Location	Juinagar, Mumbai
Span	78.8m
Width	5.5m
Height	10.5

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

TO STUDY AND DESIGN ENCASED COLUMN BY USING E-TABS SOFTWARE.

Kaveri Sonawane[1,*] Madhuri Raut[2,*] Priyanka Satve[3,*] Tanvir Maniyar[4,] Rushikesh Ugle[5,*] Dhananjay Desale[6,]

[1,2,3,4,5]*Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[6] *Assistant Professor, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding Author: [1] kaveris2020@gmail.com, [2]rautmadhuri6625@gmail.com,,[3]dhananjay.desale@ggsf.edu.in

AIM AND OBJECTIVE: Compression members are structural elements primarily subjected to axial compressive forces and hence, their design is guided by considerations of strength and buckling. These compression members may be made of bricks or reinforced concrete. Herein, reinforced concrete compression members are discussed. Concrete and steel, in the form of reinforcement, are the materials that are commonly used in construction for most of the structures. Concrete members have the advantage of high compressive strength and stiffness, where steel members having high tensile strength and ductility. The combined use of Steel and Concrete in compression member would be favorable for strength of entire structure. In encased column construction system has been extensively used in japan over the year the structural system is also known as steel reinforced concrete construction. The most important and most frequently encountered combination of construction materials is that of steel and concrete, with applications in multi-storey commercial buildings and factories, as well as in bridges. These materials can be used in mixed structural systems, for example concrete cores encircled by steel tubes, as well as in composite structures where members consisting of steel and concrete act together compositely. The structural system composed of steel and reinforced concrete has an excellent earthquake resistance in terms of strength and deformation capacity, is known as Encased column. The structural design process and construction works are more complicated than those for conventional reinforced concrete structures. The Concrete Encased

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

PHYSICAL PROPERTIES OF GEOPOLYMER CONCRETE

Aditya S. Avhad [1], Sahane S. Vikas [2], Amol B. Gorde [3], Chetan B. Deore[4], D. S. Desale [5],

[1, 2, 3, 4, 5] *Department of Civil Engineering, Guru Gobind Singh College of Engineering and Research Centre, Nashik, M.S., India*

AIM AND OBJECTIVE: Geopolymer in New invention in the world of concrete. Gepolymer concrete is simply replacement of cement instead of cement we are going to use fly ash. F type for binding purpose two chemical namely sodium hydroxide and sodium silicate are going to use. Further we are going to check physical properties by changing ratio of alkaline activator solution to fine aggregate from 0.35-0.45 and finally we are going to compare strength, temperature effect, work ability of Geopolymer concrete with Normal concrete.

Keywords: Fly ash, Geopolymer Concrete, change in ratio, Heat-cured, Compressive Strength, Comparison.

INTRODUCTION

The name geopolymer was formed by a French Professor Davidovits in 1978 to represent a broad range of materials characterized by networks of inorganic molecules (Geopolymer Institute 2010).The geopolymer depend on thermally activated natural materials like Meta kaolinite or industrial by-products like fly ash or slag to provide a source of silicon (Si) and aluminum (Al). These Silicon and Aluminium is dissolved in an alkaline activating solution and subsequently polymerizes into molecular chains and become the binder. habitation. The health examination of concrete building called as "Structural audit", is an overall health and performance check-up of building like a doctor examines a patient. It also suggests suitable Repair and Rehabilitation to increase the serviceability and life span of the building/ structure. Professor B. Vijaya Rangan (2008), Curtin University, Australia, stated that, "the

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

SOIL STABILIZATION USING FLY ASH AND IRON DUST

Makhdoom Baig[1, *] Zoheb Deshmukh[2, *] Nida Sayyed[3]

[1,2,3,] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[5] *Assistant Professor, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding author: [1]baigmakhdoom786@gmail.com [2]zohebdeshmukh79@gmail.com
[3]nidasayyed90@gmail.com

AIM AND OBJECTIVE: To find the effect of fly ash and iron dust on black cotton soil by doing testing on the composite material.

PROBLEM STATEMENT:

A large part of central India and a portion of South India are covered with Black Cotton soils. These soils are residual deposits formed from basalt or trap rocks. Black cotton soils are clays of high plasticity. The shearing strength of the soil is extremely low, is highly compressible and has very low bearing capacity. It is very difficult to work with this soil, as do not possess sufficient strength to support the loads imposed upon them either during construction or during the service life of the structure.

The poor engineering performance of such soils has forced engineers to attempt to improve the engineering properties of poor quality soils. The use of fly ash and iron dust has successfully proved itself in increasing shear strength of the soil. The appropriate proportion of both the material will help to increase stabilization property of soil using minimum costing.

From the research paper it is concluded that by replacing fly ash with black cotton soil at different proportion the liquid limit and plastic limit decreases as the proportion of fly ash

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

FEASIBLE LOW COST HOUSING

Rohit Aher[1,*] Neha Bhadke [2,*] Anushka Chavan[3,*] Umesh Gaikwad[4,*] V. M. Natraj[5,]

[1,2,3,4] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*

[5] Associate *Professor, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding author: [1]rohitaher360@gmail.com, [2]nehabhadke98@gmail.com, [3]anushkbharat@gmail.com

AIM AND OBJECTIVE: The demand for building materials has been continuously rising with the increasing need for housing both in urban and rural areas. Construction of low cost housing by using the low cost building materials increases the access to buildings by low income group peoples. Low cost housing can be achieved by use of efficient planning and project management, low cost materials, economical construction technologies and use of alternate construction The resources used to manufacture construction materials affect the environment by depleting natural resources, using energy, and releasing pollutants to land and water. In this we are going to study the different alternative construction material and estimate low cost house according 'PRADHAN MANTRI AWAS YOJNA'

PROBLEM STATEMENT

[1] Housing to all at affordable cost is a prime need.

[2] The slum areas are not developed due to poverty as the people living there cannot afford houses for themselves.

[3] Depletion of natural resources used for making building materials.

[4] Gap between research and its application on field.

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

SMART SIGNAL AND TRAFFIC MANAGEMENT SYSTEM

Suresh Sutar[1, *] Himanshu Gawale[2, *] Rohit Uphade[3, *] V. M. Natraj[4]

[1, 2, 3] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[4]*Associate Professor, Department of Civil Department, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding author: sutarsuresh819@gmail.com[1] gawaleh@gmail.com[2] uphaderohit007@gmail.com[3] vm.natraj@ggsf.edu.in[4]

AIM AND OBJECTIVE: To reduce the traffic and chaos created at various intersections of roads. The focus of "Next Generation of Smart Traffic Signals," an Exploratory Advanced Research (EAR) Program project, is a system that with little human intervention continuously monitors, learns, predicts, and responds to traffic demands and conditions with optimal signal timing for prevailing conditions. Adaptive signal control has demonstrated economic and customer satisfaction benefits—reducing travel time, delays, and stops—and has been used in other countries for more than three decades, most jurisdictions in the United States still use fixed-length, time-of-day traffic control systems. Improvements in technologies associated with adaptive traffic control have paved the way for a next generation of adaptive systems that may spur broader implementation. Hardware memory and processors, including add-on processor boards for legacy hardware, now offer more powerful computing resources at a reasonable cost. Detector technology is also presenting new possibilities, including small, ireless, individual detectors.

PROBLEM STATEMENT

Ever increase in population has increased the number of vehicles plying on road, which leads to traffic congestion and chaos on various parts of road and at intersections of roads. Increasing number of vehicle results in increased stoppage time at intersections. On opening of signal

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

WETLAND SURVEY OF DINDORI TALUKA BY ADVANCED TOOL GIS AND GPS

Prasad Dandawate[1,*] Gajanan Suryawanshi[2,*] Aakash Kandekar[3,*] Shubhangi Mandlik[4,*] Punam Patil[5,*] Akshay Ranalkar[6,*] V. M. Natraj[7,*]

[1,2,3,4,5,6] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[7] *Associate Professor, Department of Civil Engineering, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding author: [1]prasaddandawate007@gmail.com, [2]gajanansuryawanshi6@gmail.com, [3]vm.natraj@ggsf.edu.in

AIM AND OBJECTIVE: To conduct land classification survey to identify wetland of Dindori Taluka, Nashik District, study and analyze wetland area in this region using advanced tool GPS & GIS. Land area covered by water is known as Wetlands. The wetland region of Indian comprise of 27,403 wetlands, of which around 4000 are coastal wetland. 2-3% of wetland area is lost in every year in India. Present conventional techniques of wetland survey in a region, like the hydrographical surveys are cumbersome, costly and time consuming instead of this Geo Positioning System and Geographic Information System are adopted. Using satellite image of field through its spatial, spectral and temporal attributes can provide synoptic, repetitive and timely information regarding the water spread area of the reservoir. During this survey the features of Palkhed dam, Ozarkhed dam, Punegaon dam, Tisgaon dam, Karanjvan dam, Waghad dam studied. Collection, analysis of data and results obtained by using GPS and GIS will provide the different land coverage area in Dindori taluka which may be used for classification of land as Barren land, Fallow land, Crop and Crop waste. This analyzed data which helpful to Water Resources Dept. for execute present situations in Dindori of water spread area, future planning and restoration of water.

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

ENHANCEMENT OF BLACK COTTON SOIL BY USING EGG SHELL POWDER & LIME

Aarati Chandole[1,*] Dipali Sonawane[2,*] Snehal Wankhede[3,*] T.A.Kulkarni[4,*]

[1,2,3] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[4] *Assistant Professor, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding author: [4,]tejashri.kulkarni@ggsf.edu.in*

AIM AND OBJECTIVE: Expansive soil popularly known as black cotton soils in India, this soil is most problematic soil from Civil Engineering construction point of view. Soil is one of the most important materials used in a variety of construction projects. The fact that soil may provide all the resistance characteristics necessary for any structure is important hence it is necessary to improve soil properties. Soil stabilization is improving physical properties and mechanical properties of soil. This can be done by using eggshell powder and lime. It may help to both remove environmental problem and contribute to the economy. Soil enhancement is done essentially to prevent cracking and breaking up of foundation. Stabilization is aimed at improving the engineering & Index properties of soil. Which may involve increasing the soil density, cohesion. Frictional resistance and reduction of plasticity index. The effect of Eggshell Powder (ESP) and lime for stabilizing on an expansive clay soil. Using waste products in BC soil enhancement it not only increases the soil stability and strength but also serves as a method of waste disposal. We increase the bearing capacity of soil and reduce the swelling and shrinkage behavior of soil by using various percentages in variation of ESP and Lime. Various factors that affect the swelling behavior of these soils, the basic mineralogical composition is very important. Improve the compaction characteristics of Black cotton soil by addition of 5% of ESP+ 5% Lime powder.

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

ANALYZING THE PERFORMANCE OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY ALCCOFINE AND FLY ASH

Chaudhari Mohit.P[1] Kanyalkar Pranit.D[2] Motwani Yash.R[3] Gavit Rohan.R[4]
Ahire Priyanka. A[5], D.O.Bhavar[6]

[1, 2, 3, 4, 5,6]*Department of Civil Engineering, Guru Gobind Singh College of Engineering and Research Centre, Nashik, M.S., India*
[6]*Asst. Professor Department of Mechanical Engineering, Guru Gobind Singh College of Engineering and Research Centre, Nashik, M.S., India*

Corresponding Author: [1,*]thatspranit@gmail.com, [6,*]dadasaheb.bhavar@ggsf.edu.in

AIM AND OBJECTIVE: The project work is focusing on studying the influence of alccofine in achieving high strength concrete. The analysis of the performance of concrete with various combinations, in which cement is partially to be replaced by two ingredients. These two ingredients viz. are Fly ash and Alccofine. The test samples are prepared by designing M25 mix of concrete and are placement of Fly ash and Alccofine to cement by 15, 20 and 25% of weight. Research papers have shown that the replacement by alccofine reduces water demand for same workability by producing dense pore structure, ultimately gaining high strength. The durability of concrete also is proven to be improved.

INTRODUCTION

Alccofine is a specially processed product based on slag of high glass content with reactivity, obtained through the process of controlled granulation [5].Alccofine is a new generation product,havingultrafine size with less calcium silicate content, easily available in India.Alccofine can also be utilized as a highest range water reducer to improve compressive strength or as a super workability aid to improve flow [7]. Alccofineis known to produce high-strength concrete and is used in two different ways for cement replacement, to reduce the cement content and as an additive to improve the concrete properties [5].

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

SOIL IMPROVEMENT BY USE OF CALCIUM CARBIDE RESIDUE

Gaurav Wagh[1,*] Bhupendra Patil[2,*] Tejashri A. Kulkarni[3,]

[1,2] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[3] *Assistant Professor, Guru Gobind Singh College of Engineering and Research Centre, Nashik*

Corresponding Author: [1]en0001018@gmail.com, [2]patilbhupendra07@gmail.com
[3] tejashri.kulkarni@ggsf.edu.in

AIM AND OBJECTIVE: Expansive soil in India are appreciate to farmers but problematic to civil engineers. Civil engineering structures experience large scale or damaged due to change in properties of soil. Expansive soil always pose challenges to foundation engineers in India.

The soil which expand when water is added, and shrink when the dry out that soil called as ''Expansive Soil''. This continuous change in soil volume can cause homes built on this soil to move unevenly and crack.

Expansive Soils pose problems to civil engineers in general and to geotechnical engineers in particular. They cause to damaged structure they cause damage to structures founded in them because of their potential to react to changes in moisture regime. They undergo a sever volume changes corresponding to changes in moisture content. They swell or increase in their volume when they imbibe water and shrink are reduce in their volume on evaporation of water because of their swelling and shrinkage, they result in detrimental cracking lightly loaded civil engineering structure such as foundation, retaining wall, pavements, airports, sidewalks, canal beds, and lining.

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

CONCRETE MIX DESIGN BY PACKING DENSITY METHOD

Prashant Chauhan[1,*], Shubham Gunjal[2,*] Sanika Mehetre[3,*] Tejashri Kulkarni[4,*]

[1,2,3]*Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[4]Asst. Professor, Department of Civil Engineering, *Guru Gobind Singh College of Engineering and Research Centre, Nashik*

Corresponding author:[1)] tejashri.kulkarni@ggsf.edu.in, [2)] prashant.chauhan1997@gmail.com
[3)] gunjal700@gmail.com [4)] mehetresanika@gmail.com

AIM AND OBJECTIVE: The Aim of the project is to introduce the concept of sustainability to a residential building.

PROBLEM STATEMENT

As population in India is increasing daily which results in increasing consumption of water, by which the generation of wastewater preferably sewage is increasing rapidly. Due to large amount of organic waste generated, the burden on Common Solid Waste Management Facility increases. Moreover the organic food waste generating from each household causes unhygienic condition in Residential Building. Also use of Reverse Osmosis (RO) leads to generation of RO Reject which gets mixed with wastewater to increase the load on Common Sewage Treatment Plant and increases the growth of water pollution in streams/ rivers. Due to scarcity of water many regions faces drought like consequences so to deal with the scarcity of water, the wastewater can be utilized again.

- To adopt decentralized method of sewage treatment so as to reduce the burden on centralized sewage treatment plant.

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

BANDHARA IRRIGATION

Aher Dhananjay V[1]. Aher Revati S. Bhosale[2] Pravin V. Ghumare Sakshi[3] P. Wagh Ajay R.[4]
Wagh Kartik A.[5] P. B. Shinde[6]

[1,2,3,4] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[6]*Assistant Professor, Guru Gobind Singh College of Engineering and Research Centre, Nashik.*

Corresponding author: aherdhananjay25@gmail.com revatiaher77@gmail.com pravinbhosalestar@gmail.com ghumares1999@gmail.com waghajay461@gmail.com kartikwagh3112@gmail.com, Pravin.shnde@ggsf.edu.in

AIM AND OBJECTIVE: Bandhara irrigation comes under minor irrigation project . In minor irrigation project special intension is given on smaller area say (5 to 2000ha) for irrigation & having expenditure limit of Rs. 5 million. The bandhara is a local name and in a bandhara irrigation is a small barrier or a wall of small height is constructed across the river or stream to raise water on u/s side in which gates should be detachable which can be fixed manually or automatically after monsoon. The main object of bandhara is to rise water level on u/s side so that it can be diverted into canals on one or both side of banks it serves purpose of irrigation during long dry spell in monsoon .By enhancing the scope of existing bridge & covering it into water retaining structure, the availability of water can be increased. Appropriate secondary piers & gates are needed to bridge structure so as to plan it as BCB. Gate should be detachable which can be fixed manually or automatically after monsoon. The standard type plan have been evolved to convert existing bridge into BCB.

PROBLEM STATEMENT

In our country many rivers run dry after the end of the monsoon , it is a need of day to block the post monsoon flow for drinking , irrigation etc. purpose.

Proceedings of the

National Level Technical Symposium

On

Under Graduate Projects

Date: 20th to 22nd June 2020

Organized By

Guru Gobind Singh Foundation's

Guru Gobind Singh College of Engineering and Research Centre, Nashik

Our Partners - Student Chapters

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2020

Volume 1, Issue 2,
Track-Civil Engineering
Pages 001-211 (2020)

ISBN:978-93-5407-601-5

The Proceedings of the National Level Technical Symposium on Undergraduate Project (TechSearch-2020) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically the proceeding covers various chapters abstract's based on projects presented at the symposium.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

National Level Technical Symposium 2020

20th to 22nd Jun 2020

LIST OF PRESENTED PAPERS

Track – Civil Engineering

Paper ID	Title	Author
CE-01	Introduction to Concept of Sustainability to A Residential Building	Kunal Vishwas Bachhav
CE-02	Concrete Mix Design by Packing Density Method	Tejashri Kulkarni
CE-04	Turbulent Low Head Vortex Turbine	Abhijeet Nemade
CE-05	"Comparing the Strength as Blocks Made from Cement and Lateritic Soil Cement"	Rohansingh Gulabsingh Pardeshi
CE-06	Manufacturing of Fly Ash Bricks with Partial Replacement of Glass Powder	Bramhadeo Premsing Rathod
CE-07	A Combined Approach for Disinfection and Softening of Drinking Water by Using Hydrodynamic Cavitation.	Abhishek Mahavir Latthe
CE-08	Assessment of Environmental Quality Index of Indira Nagar Region	Gaikwad Pooja Arun
CE-09	Qualitative Analysis of Water and Wastewater for Guru Gobind Singh Foundation	Mrs. V.O.Kulkarni (Staff)
CE-10	Physical Properties of Geopolymer Concrete	Aditya.S.Avhad
CE-11	Water Distribution System of Golegani Village Using Epanet 2.0	Manasi Mahendra Patil

FLEXURAL STRENGTH OF RC-BEAMS WRAPPED WITH ARAMID FIBRE

Pallavi Baviskar[1,*], Chetan Raut[2,*], Dnyaneshwar Mali[3,*], Tejas Gaikwad[4,*], Omkar Ahirrao[5,*], P. B. Shinde[6]

[1,2,3,4,5] *Students, Guru Gobind Singh College of Engineering and Research Centre, Nashik*
[5] *Assistant Professor, Department of Civil Engineering, Guru Gobind Singh College of Engineering and Research Centre, Nashik*

AIM AND OBJECTIVE: Now a day's building are found to be damaged because of change in function of building exposure to environmental conditions and due to use of older provisions. Today deterioration of RCC structural is one of the major problems in civil industry Mostly large number of building are constructed as per older design code in different parts of the world, thus are structurally unsafe, according to present design codes, since replacement of such deteriorated structure takes plenty of money and time. It is necessary to find repair techniques suitable in terms of low costs and fast processing time. Much of our current infrastructure is constructed of concrete. As time passes, deterioration and change of use requirements facilities the need for new structures. Demolition of existing and construction of new structure is a costly, time consuming and resource intensive operation. Externally bounded FRP sheet can be used to increase as flexural strength of reinforced polymer sheets using flexural strength of reinforced polymer sheets using flexural strength method adopted by theoretical analysis. In construction industry they can be used for cladding or for structural elements in highly aggressive environment. Aramid fiber is kind of complex material with light weight. It is convenient for construction with great strength and efficiency it is used to improve the bearing capacity in the strengthening restoration of the structure.

PROBLEM STATEMENT & OBJECTIVES

High Performance Testing Machine is expected to have increase performance characteristics for better result. High Performance Concrete expected to have performance

Paper Sr. No - 18

Manual describes various practicals which are related to Pune University Syllabus, which are related to advanced equipment's' such as Total Station, One second micro optic theodolite, Mirror Stereoscope etc. Use of total station its operation, various concepts such as remote elevation, remote distance, co-ordinate stake out and many more are described in this book. The procedure of various practicals which are concerned with topographic surveying is mentioned in simplified manner in this book.

PRAVIN BHANUDAS SHINDE
SANGITA PRAVIN SHINDE
AKASH RAJENDRA AVHAD

ADVANCED SURVEYING MANUAL

P. B. Shinde has completed his UG and PG from AVCOE ,Sangamner. Presently he is doing his PhD in Oriental University Indore. He has eight years of teaching experience. Now he is working as Assistant Professor in GCOERC Nashik.

9 786203 197655

LAP LAMBERT Academic Publishing

Paper Sr. No - 19

Manual describes various practicals which are related to Pune University Syllabus, which are related to advanced equipment's' such as Total Station, One second micro optic theodolite, Mirror Stereoscope etc. Use of total station its operation, various concepts such as remote elevation, remote distance, co-ordinate stake out and many more are described in this book. The procedure of various practicals which are concerned with topographic surveying is mentioned in simplified manner in this book.

PRAVIN BHANUDAS SHINDE
SANGITA PRAVIN SHINDE
AKASH RAJENDRA AVHAD

ADVANCED SURVEYING MANUAL

P. B. Shinde has completed his UG and PG from AVCOE ,Sangamner. Presently he is doing his PhD in Oriental University Indore. He has eight years of teaching experience. Now he is working as Assistant Professor in GCOERC Nashik.

9 786203 197655

LAP LAMBERT Academic Publishing

19TH & 20TH SEPTEMBER

GLOBAL CONFERENCE HUB

International Conference on Innovations in Engineering Sciences (ICIES - 2020)

CONFERENCE PROCEEDINGS

ICIES 2020

IRJASH
eISSN : 2582 - 4376
Journal Partner

International Conference on Innovations in Engineering Sciences (ICIES 2020)

RSP SCIENCE HUB

(The Hub of Research Ideas)

Available Online at www.rspsciencehub.com

FIRST INTERNATIONAL CONFERENCE ON INNOVATIONS IN ENGINEERING SCIENCES (ICIES 2020)

(ONLINE)

19 & 20th SEPTEMBER 2020,

COIMBATORE, INDIA

ABOUT THE CONFERENCE

ICIES-2020 is an international peer reviewed conference dedicated to the advancements in Research and Development. It promotes collaborative excellence between academicians and professionals from academics. The objective of ICIES-20 is to provide an opportunity for academicians and industrialist from various fields with cross- disciplinary interests to bridge the knowledge gap, promote research esteem and the evolution of pedagogy. This conference is an amalgamation of industrialists, academia where they can gear up knowledge. Our gratitude towards people who are concerned about Advancements in hub of research and we cordially invite them to gear up and make the congress a unforgettable successful event.

ACKNOWLEDGEMENT

The editor and organizer of the ICIES-2020 Conference wish to acknowledge the keynote speakers for their valuable presentation on19/09/2020 & 20/09/2020. The organizers also wish to acknowledge publicly the valuable services provided by the reviewers and editorial board members. On behalf of the Editors, Organizers, Authors, and Readers of this Conference, we wish to thank the keynote speakers and the reviewers for their time, hard work, and dedication to this Conference. Without their services, the editors could not maintain the high standards of Research. The Editor expresses his special thanks to head of the Publication, Production & Conference Organisers Prof.C.Somu, Prof.T.Pravin & Prof. M.Saravanakumar for his tireless effort to make his conference a great success. The Organizer expresses his gratitude to the conference chair, Dr.Shaziya Mohammed Irfan Momin, Dr.B.Prabakaran, Dr. K.Ramya, Dr. B. Surendiran, Dr. Manju Gupta and Dr. N. T. Renukadevi for his valuable support. The organizers also wish to acknowledge the participants who attend the conference.

International Conference on Innovations in Engineering Sciences (ICIES 2020)
RSP SCIENCE HUB
(The Hub of Research Ideas)
Available Online at www.rspsciencehub.com

ICIESAP1002

Teaching-Learning Process in Engineering using Virtual Instrument based on LABVIEW

Pramod S. Aswale[1], Amit Kumar Mishra[2],TanmayBharambe[3], Ganesh Gaikwad[4]

[1] Assistant Professor, Department of E& TC Engg, SIEM , Nashik, Maharashtra

[2] Assistant Professor, Department of E& TC Engg, SIEM, Nashik, Maharashtra

[3] Assistant Professor, Department of Electrical Engg, SIEM, Nashik, Maharashtra

[4]Assistant Professor, Department of Computer Engg, SIEM, Nashik, Maharashtra

ABSTRACT

The development of undergraduate laboratories is more expensive if a hand on training approach is considered. Additionally, relatively much inexpensive software can work a standard personal computer (PC) into a virtual lab. The fundamental issues are to set up balance between real and virtual labs to rectify cost related issue while graduating engineers with sufficient practice. This article is useful in a virtual experiment for work of teachers and students in Electronics and Provides a precise and extensive design scheme by which learners can taught engineering experimentation and virtual instrumentation. This virtual experiment platform support classroom teaching using which the teacher can constitute a hi-tech atmosphere, as well as provides exercises and tests self learning of students. A Simulation enriches coaching and enlarges teaching quality. The educational problem is to improve students experience of learning Electronics and telecommunication fundamentals using LabVIEW. LabVIEW was widely used in the laboratory sessions, to improve students for the project work.

Keywords: E-learning, Labview, Virutal Instrumention

Proceeding Book of International Conference on
Emerging Trends in Engineering and Technology
Nashik, 28th – 29th May 2020

A Numerical Study for Electricity Generation by applying potential head of waste water flowing down through vertical drainpipes of High Rise Building by Using systems of very small Turbines

A.G. Chaudhari, Assistant Professor, Guru Gobind Singh College of Engineering & Research Center, Nashik.
Dr. V. M. Natraj, Associate Professor at Guru Gobind Singh College of Engineering & Research Center, Nashik.

Abstract:--

The demand on energy is continuously increasing. Small or large strategies either to save or generate energy are being continuously developed. This paper reports the numerical results to generate electricity by use of wastewater from high rise building while falling down through vertical drain-pipe. The three alternate arrangements have been arbitrarily selected for the study. Wastewater collected from bath rooms, basin and kitchen sink are collected in the storage tanks. These tanks may be located at selected floor level of building and connected by the pipe systems along-with pico (small) turbines, to generate power. The results of three different cases shows variations in electricity generation as the amount of the waste water varies with the quantity of waste water and potential head. The test results also revealed that there is an opportunity for electricity generation by utilizing waste water of High rise buildings and may be used as an alternative source for electricity generation.

Index Terms

Energy, wastewater, high rise building, Electricity generation, Pico Turbine.

International Journal of Disaster Recovery and Business Continuity
Vol.11, No. 3, (2020), pp. 1941–1948

A Numerical Study for Electricity Generation by applying potential head of waste water flowing down through vertical drainpipes of High Rise Building by Using systems of very small Turbines.

[1] Mr. A.G. Chaudhari, [2] Dr. V. M. Natraj
[1] Assistant Professor, [2] Associate Professor at Guru Gobind Singh College of Engineering & Research Center, Nashik.
[1]ajay.chaudhari21@gmail.com, [2] vm.natraj@ggsf.edu.in

Abstract

The demand on energy is continuously increasing. Small or large strategies either to save or generate energy are being continuously developed. This paper reports the numerical results to generate electricity by use of wastewater from high rise building while falling down through vertical drain-pipe. The three alternate arrangements have been arbitrarily selected for the study. Wastewater collected from bath rooms, basin and kitchen sink are collected in the storage tanks. These tanks may be located at selected floor level of building and connected by the pipe systems along-with pico (small) turbines, to generate power. The results of three different cases shows variations in electricity generation as the amount of the waste water varies with the quantity of waste water and potential head. The test results also revealed that there is an opportunity for electricity generation by utilizing waste water of High rise buildings and may be used as an alternative source for electricity generation..

Index Terms— *Energy, wastewater, high rise building, Electricity generation, Pico Turbine.*

I. INTRODUCTION

Greywater is specifically wash water available from bathrooms, cleaning of dishes, and laundry; excluding toilet wastes and free of garbage-grinder residues. When properly managed, greywater is a valuable resource for horticultural agricultural and home gardener's purposes. The phosphorous, potassium and nitrogen etc. available in greywater serve as a source of pollution for lakes, rivers and ground water. Central Public Health and Environmental Engineering Organization (CPHEEO) estimates about 70-80% of total water supplied for domestic use gets generated as wastewater. Wastewater treatment and reuse is a crucial issue and scientists are trying to find inexpensive and suitable technologies. (Vinod Kumar Gupta, 2012). It is also seen that domestic wastewater recycling is still in its infancy and there is still a paucity of reliable information relating to both the nature of waste water and the range of recycling technologies available. (B Jefferson, 2000; B Jefferson, 2000). The recent trends in wastewater reuse are for direct reuse in urban environments such as landscape irrigation, toilet flushing, industrial uses, recreational and ornamental impoundments. With tertiary and advanced wastewater treatment, groundwater recharge has been implemented. Indirect or direct potable water reuse has been intensively studied and are being implemented. (Levine, 1996). In reuse of waste water the generation of electricity have been thought of by earlier researchers. Microbial fuel cells (MFCs) are used to produce electricity from different compounds, including acetate, lactate, and glucose. Logan (Logan, 2004) showed that electricity can be produced using MFC from domestic wastewater, simultaneously achieving removal of chemical oxygen demand.

Despite a long history of wastewater reclamation and reuse in many parts of the world, the use of potential energy of waste water for power generation before disposing it in city sewer line has been

ISSN: 2005-4289 IJDRBC

hardly investigated. The population and living standard of people is increasing and the trend of constructing high rise building have been started and reaching in major cities day by day. Due to this demand of electricity have been increased which finally result in power crisis. Generation of electricity from wastewater may results in minimizing the demand of electricity and load on wastewater treatment plant if it primarily treated for the purpose (Sarkar, Sharma, & Malik, 2014). The wastewater which can be collected from bath rooms, basin and kitchen sink in the storage tanks. These tanks may be located at various floors of building and connected by the pipe systems, with aim to generate power while flowing by using the Pico (small) turbines. Hence we propose here the best possible arrangement of waste water harvesting while falling from a certain height in high raised buildings that could be a potential source for electricity generation. This strategy for energy saving or generation that can fulfil the need of harnessing the energy fully or partially.

II. METHODOLOGY

General characteristic and Composition of Greywater:

A. Greywater from Bathroom: Waste water generated from hand wash from wash basins and bathing constitute about 50-60% of total greywater and is presumed to have low level of contamination. The contaminants usually found are soap, shampoo, hair dye, toothpaste and cleaning product. Bathing induces organic contaminants.

B. Greywater from Cloth Washing: This constitute to about 25-35% of total greywater. Usual contaminants found in greywater from cloth washing are pathogens and parasites such as bacteria.

C. Greywater from Kitchen: Kitchen greywater constitute to about 10% of total greywater. They comprise both organic waste like food particles, oils, fats and other wastes and inorganic contaminants like detergents and cleaning agents giving it alkaline nature(Zainuddin, Yahaya, Lazi, & Basar, 2009)

D. Pico Hydro Turbine: The Pico turbines is used for power generation which are suitable for hydroelectric power generation close to around 5 kW. (S.J.Williamson, 2014). It is useful in small, remote communities that require only small amount of electricity. Smaller turbine have been successfully used for hydropower generation under a head of 1m. Hence Pico hydroelectric power generation can be applied in high-rise buildings that utilizes the potential head of water that drops down through a well arranged pipe system for rotating the turbine which shall be coupled with a generator. (Zainuddin, Yahaya, Lazi, & Basar, 2009)

The Scheme of Implementation: The current work is aimed to study the practicability of the hydropower generation from the use of wastewater in high-rise buildings. Here a typical high rise building structure is selected considering G+15 floors and having six flats on each floor. The building is considered to have open parking near ground level and have no basement.

After collecting requisite volume of water, it is made to flow through the pipe over the turbine blades, thus rotating the turbine shaft. This shaft is then coupled to a generator converting the mechanical power to electrical power. This electrical power can then be directly used or stored in the batteries for later usage.

Three alternatives system have been developed for power generation. The mathematical calculations, feasibility analysis for practical usage of the proposed system are studied. Some assumptions are made as follows:

1) Waste water treatment system is existing at the desired level. The water stored in the tanks is as per the requirements and tested to identify its constituents and effects on the piping system.

2) A water collection tank provided are of height X, radius R and placed at a height (H-X) measured from the base.

3) Water after use is being discharged into the conduit pipes and in the collection tank after preliminary treatment. As shown in Figure 1.

4) The collection tank assumed to use a water level sensor to monitor the outlet discharge from the tanks. After the required volume of water is collected in the tank, sensor actuates a valve placed near the outlet pipe.

ISSN: 2005-4289 IJDRBC

5) The valve automatically opens up allowing the collected water to flow down.
6) A hydro turbine is attached at predetermined positions on the pipe as shown in the Figure 2. Water having an initial head h strikes the turbine blades thus rotating the turbine shaft.
6) Selected turbines meet the requirements of head, volume flow rate and volume of water. However, available pico-turbine designs can also be explored based upon use.
7) The turbine is further coupled to an AC generator via a gearbox. Use of a gearbox is justified to achieve the desired RPM for the generator to obtain a steady output frequency. This generated electric power can either be directly used or stored as charge in the batteries for later use.
The schematic diagrams are as follows:

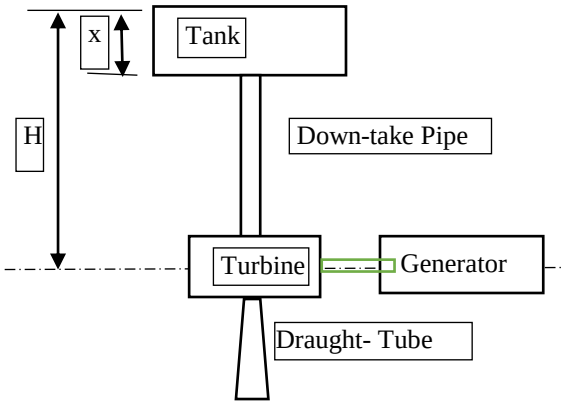


Figure 1. Schematic diagram of single loop in electricity generation

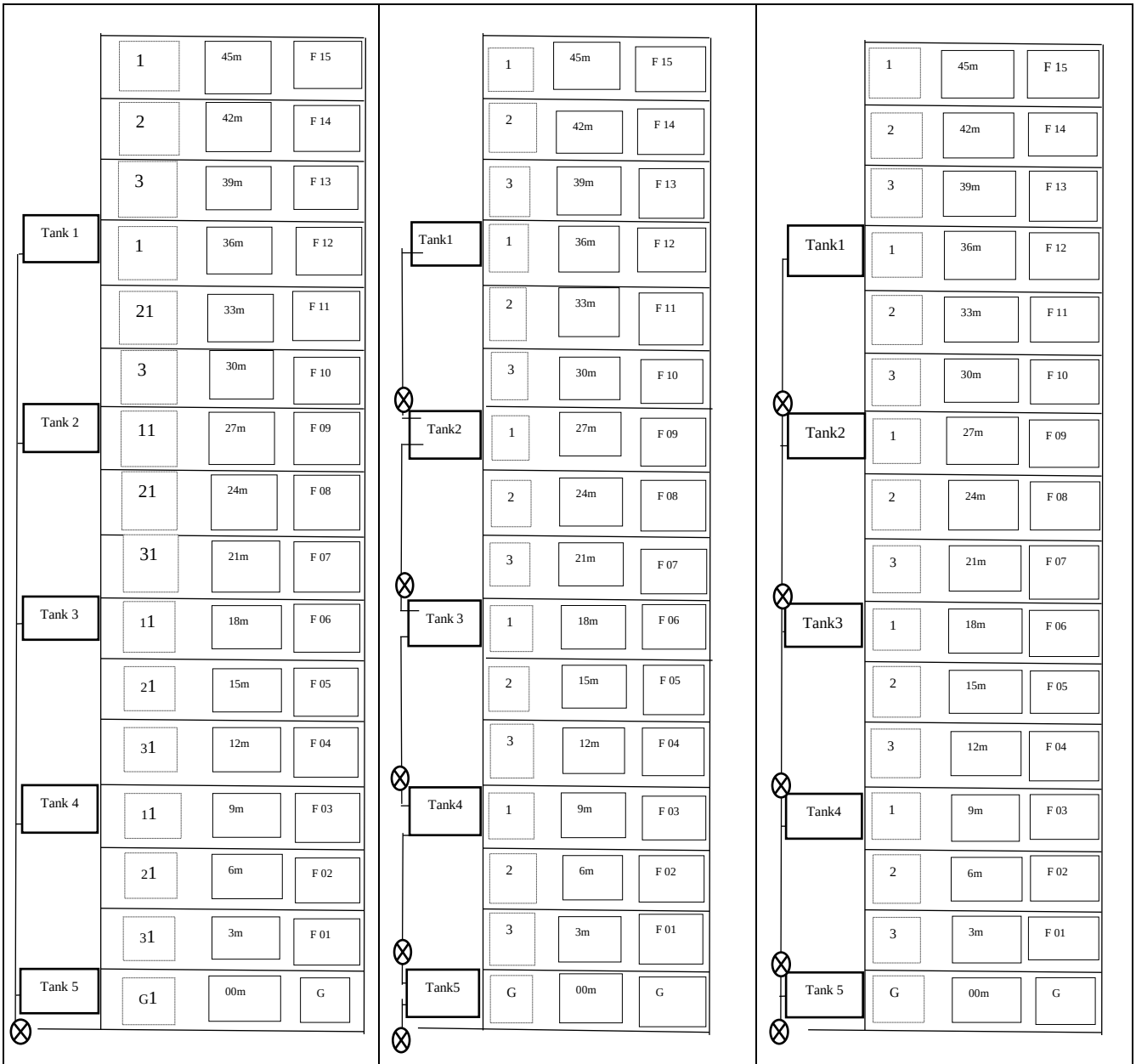
Waste Water availability estimate:
i. No. of Floors in the Building: G+15 nos.
ii. Height of Building: 48 m
iii. No. of Tanks proposed=5 Nos
iv. Height of storage tanks from axis of lowest turbine: 2m, 11m, 20m, 29m, 38m
v. No. of Flats: 6x 15 = 90 nos.
vi. No of Persons assumed to be residing in each flat= 5
vii. Total no. of persons at each floor=5x90=450 persons
viii. Per Capita water consumption per person: - 135 lit/Capita/day (As per IS: 1172-1983)
ix. Assuming 60% (as per CPHEEO estimates) availability of waste water from each floor with 30 persons; Water for storage = 0.6 x 30 x 135 = 2430 lit/day.
x. Waste water from three consecutive floor=2430 x 3 =7290 lit/day say 7250 lit/day
xi. Size of down take pipe = 12.5mm=0.0125m
xii. Area of down take pipe=1.2272 $x10^{-4}$ Sq.m.

The cases studied are as follows:
Case1: Providing single turbine at lowest level generally at ground level water is supplied trough single down-take pipe.

Case 2: Providing individual turbine near immediate lower tank and discharge of draught is collected in it.

Case 3: Providing turbine near immediate lower tank in series.

ISSN: 2005-4289 IJDRBC



a) Case1 b) Case 2 c) Case 3

Figure 2. a) Case 1: Providing single turbine at lowest level generally at ground level water is supplied trough single down-take pipe**. b) Case 2:** Providing individual turbine near immediate lower tank and discharge of draught is collected in it **c) Case 3:** Providing turbine near immediate lower tank in series.

⊗… Indicates Position of Turbine, 00m…45m… Indicates floor height, F01-F015… Indicates number of floor

Case1: In this case motor and grey water collection tank provided at top three floors of building and turbine placed at parking of building as in **Figure 2** a.

Case 2: In this case tank provide at floor with different head and turbine at bottom of building, no input power required as in **Figure 2** b.

Case3: In this case at middle of building floor tank and turbine arrangement as shows in **Figure 2** c.

ISSN: 2005-4289 IJDRBC

III. RESULTS AND DISCUSSION

Observations and calculations are summarized in the table 1. The results obtained from investigations are summarized in table 2.

Case 1: In this case output energy generation is less than 3rd case but more than other 2nd case. The power generation is
more due to the largest head availability as the turbine is located at the lowest level near ground.
Case 2: In this case discharge from the upper tank are collected at immediate lower tank provided at floor. There is lowest gain of energy as the very small head is available for the turbine in power generation.
Case3: Providing turbine near immediate lower tank in series. There is largest gain of power as each discharge is striking to each lower turbine and contributing in power generation.

Thus it has been found that the Case 3 gives the best possible result for the power generation.

Table 1 Summary of Observations and calculations of cases under consideration

ISSN: 2005-4289 IJDRBC

Sr. No	Description	Head H m	Vol of Water cum	Theoretical velocity V of flowing water from each tank ($\sqrt{2gH}$) m/sec	Theoretical Discharge $Q = AV$ m3/sec 10^{-3}	Theoretical Power generated in unit volume of water $P = \rho g H \eta$ watt/m	Total power generated by full tank storage watt	Discharge in terms of Tank Volume of 7250 lit	Total Watts
Case1: Providing single turbine at lowest level generally at ground level water is supplied trough single down-take pipe.									
1	Tank 1	38	7.25	27.3	3.35	749.49	5433.58	Single volume	12036.22
2	Tank 2	29	7.25	23.85	2.926	499	3617.75	Single volume	
3	Tank 3	20	7.25	19.80	2.429	286	2073.5	Single volume	
4	Tank 4	11	7.25	14.69	1.802	116.67	845.85	Single volume	
5	Tank 5	2	7.25	6.26	0.768	9.04	65.54	Single volume	
Case 2: Providing individual turbine near immediate lower tank and discharge of draught is collected in it.									
1	Tank 1	3	7.25	7.67	9.41	16.61	117.16	Single volume	1511.65
2	Tank 2	3	14.5	7.67	9.41	16.61	234.32	twice volume	
3	Tank 3	3	21.75	7.67	9.41	16.61	351.48	Three times volume	
4	Tank 4	3	29	7.67	9.41	16.61	481.69	Four times volume	
5	Tank 5	2	36.25	6.26	7.68	9.04	327	Five times volume	
Case 3: Providing turbine near immediate lower tank in series.									
1	Tank 1	3	7.25	7.67	9.41	16.61	120.48	Single volume	19897.66
		12	7.25	15.34	1.88	132.78	962.71		
		21	7.25	20.29	2.48	306.54	2222.43		
		30	7.25	24.26	2.97	524.44	3802.19		
		32	7.25	25.05	3.07	578.24	4192.24		
2	Tank 2	3	7.25	7.67	9.41	499	3617.75	Single volume	
		12	7.25	15.34	1.88	132.78	962.71		
		21	7.25	20.29	2.48	306.54	2222.43		
		23	7.25	21.24	2.60	351.98	2551.85		
3	Tank 3	3	7.25	7.67	9.41	286	2073.5	Single volume	
		12	7.25	15.34	1.88	132.78	962.71		
		14	7.25	16.57	2.03	167.28	1212.78		
4	Tank 4	3	7.25	7.67	9.41	116.67	845.85	Single volume	
		5	7.25	9.90	1.21	35.61	258.17		
5	Tank 5	2	7.25	6.26	0.768	9.04	65.54	Single volume	

ISSN: 2005-4289 IJDRBC

Table 2 summary of the results of cases under consideration

Case No.	Description	No of tanks	Collected water (Lit.)	No. of turbi-neon floor	Energy (Watt. Hrs.)
1.	In this case motor and grey water collection tank provided at top three floors of building and turbine placed at parking of building.	5	36250	1	12036.22
2.	In this case tank provide at floor with different head and turbine at bottom of building, no input power required.	5	36250	5	1511.65
3.	In this case at middle of building floor tank and turbine arrangement.	5	36250	5	19897.66

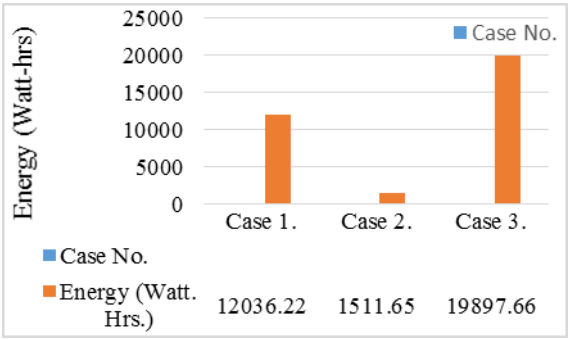


Figure 3. Bar chart shows power generation of cases

CONCLUSION

From this work, it is clear that power generation in high rise buildings using Pico-hydro turbine is considerably feasible, efficient and eco-friendly. With the unique design of this hydropower turbine, it is able to generate electricity at different flow rate. Providing turbine near immediate lower tank and connecting in series with few number of lower level turbine gives more electricity output.

ISSN: 2005-4289 IJDRBC

REFERENCES

[1] B Jefferson, A. L. (2000). Technologies for domestic wastewater recycling. Urban Water, 1(4), 285-292. doi:https://doi.org/10.1016/S1462-0758(00)00030-3
[2] Levine, T. A. (1996). Wastewater Reclamation, Recycling and Reuse: Past, Present, and Future. Water Science and Technology, 33(10-11), 1-14. doi:doi.org/10.1016/0273-1223(96)00401-5
[3] Logan, H. L. (2004). Production of Electricity during Wastewater Treatment Using a Single Chamber Microbial Fuel Cell. Environmental Science & Technology, 38(7), pp. 2281-2285. doi:https://doi.org/10.1021/es034923g
[4] Rajneesh K. Gautam, (2017).Sewage Generation and Treatment Status for the City of Delhi, its Past, Present and Future Scenario- A Statistical Analysis. International Journal for Research in Applied Science & Engineering, Volume 5 (Issue V), 926-933.
[5] S.J. Williamson, B. J. (2014). Low head pico hydro turbine selection using a multi-criteria analysis. Renewable Energy, 61, 43-50. doi:https://doi.org/10.1016/j.renene.2012.06.020
[6] Sarkar, P., Sharma, B., & Malik, U. (2014). Energy generation from grey water in high raised buildings: The case of India. Renewable Energy, 69, 284-289. doi:http://dx.doi.org/10.1016/j.renene.2014.03.046
[7] Vinod Kumar Gupta, I. A. (2012). Chemical treatment technologies for waste-water recycling—an overview. Royal Society of Chemistry,Adv., 2, 6380-6388. doi:DOI: 10.1039/C2RA20340E
[8] Zainuddin, H., Yahaya, M. S., Lazi, J. M., & Basar, R. a. (2009). Design and Development of Pico-hydro Generation System for Energy Storage Using Consuming Water Distributed to Houses. World Academy of Science, Engineering and Technology International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering, 3(11), 1928-1933. Retrieved Aug 14, 2019
.

ISSN: 2005-4289 IJDRBC

Proceedings of the

INTERNATIONAL CONFERENCE ON RESEARCH CHALLENGES TO MULTI DISCIPLINARY INNOVATIONS

ICRCMI-2021

Organized by

ESTD. : 2013

Guru Gobind Singh College of Engineering and Research Center , Nasik

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2021

Volume 1, Issue 1,
Pages 0001-0344 (2021)

ISBN: 978-81-954237-0-5

The Proceedings of the International Conference on Research Challenges to Multidisciplinary Innovations (ICRCMI-2021) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically, the proceeding covers various technical reports in the fields of engineering and technology.

More information about this series at https://www.engg.ggsf.edu.in/series/e-books

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

Chief Editor:

Permindur Singh
Chief Executive Officer
Guru Gobind Singh Foundation, Nashik

Executive Editor:

Dr. Shyamkumar D. Kalpande
Professor, Department of Mechanical Engineering
Guru Gobind Singh College of Engineering and Research Centre, Nashik

Guru Gobind Singh Foundations

Guru Gobind Singh College of Engineering and Research Centre, Nashik

International Conference on

Research Challenges to Multi Disciplinary Innovation

Index

Strength and Durability Performance of Fly Ash Concrete

[1]Vishvanath Nandkumar Kanthe
[a] *Assistant Professor, Department of Civil Engineering, Guru Gobind Singh College of Engineering and Research Centre Nashik, INDIA*

Abstract- *In this research work, the effect of Fly Ash (FA) with and without super plasticizer (SP) on the properties of binary blend concrete has been reported. Ordinary Portland Cement (OPC) was replaced by 10 to 50% of FA. The compressive strength, workability, and durability performance of concrete were tested. The test results show that the highest compressive strength was achieved by 20%FA used for binary concrete than control concrete mix (CM). The satisfactory results were shown for durability test. The concrete with SP shows improved result in terms of strength than without SP concrete. Such kind of concrete is more efficient to enhance the mechanical and durability properties of concrete which save the cement. The utilization of industrial by-product makes concrete sustainable and reduce environmental problems.*

Keywords - Fly Ash, Concrete, Compressive Strength, Workability, Durability.

I. INTRODUCTION

The concrete is used in large quantity for the infrastructure development all over the world. The cement is one of the main ingredients widely utilized in concrete. The manufacturing process of Portland cement creates a large amount of CO_2 gas, and pollutes the environment [1]. The industrial and agricultural by-product such as Fly Ash (FA)[2],[3] , Ground Granulated Blast Furnace Slag (GGBS)[4], and Rice Husk Ash (RHA)[5],[6] are produced in huge quantity in India and affect the environmental balance due to its disposal problem. To overcome this problem the attention must be given to the utilization of such by-product in concrete by partial replacement of OPC[7],[6]. These types of by product were mostly in pozolanic nature. The FA is produced from coal based thermal power plant. It can be utilized as supplementary cementitious material to improve the long-term strength, workability, shrinkage[8] and durability of concrete [9],[10],[11].

The major aim of this work is to study the effect of locally available FA on compressive strength and durability of concrete with and without SP. The main advantage of binary blend concrete was to achieve the dense particle packing formed in concrete resulting enhance the mechanical and durability properties of concrete also reported by various researcher[12],[13]. FA Generation and its Utilization and utilization in India are 226.13 million tonnes and 187.81 million tonnes whereas for Maharashtra state in India is 25.02 million tonnes and 22.14 million tonnes[14] [15].

II. EXPERIMENTAL WORK

Material

In this research work the locally available materials used such as river sand, coarse aggregate, water, FA, and RHA. The OPC 43 grade with specific gravity of 3.15 was used for all concrete mix conforming to IS: 4031(1988). The river sand was used as a fine aggregate with specific gravity 2. 6 Zone II. The coarse aggregate of 20 mm maximum size was used with specific gravity 2.62 conforming to IS: 383(1970) and IS: 2386. The fly ash was arranged from thermal power plant Nashik having specific gravity of 2.21. The elemental content of the material were shown in Table 1. The water reducing superplasticizer (SP) was used based on the dosage required to enhance the performance of concrete mix. The specific gravity of SP was 1.22 conforming to IS 9103:1999. The rounded form of FA particle it useful for enhance the workability of the fresh concrete mix and minimize the demand for water and cement[16]. Fig. 1 illustrates the particle size distribution of FA, and OPC, the average particle at D10 and D50 were found that 9μm and 34μm for OPC, 6μm, and 28μm for FA particle. From this it can be viewed as the FA molecule is better than OPC.

Table 1 The elemental content of FA and OPC.

Elemental Contents (%)	Si	Ca	Al	Fe	Mg	K	Na
FA	67.22	0.64	34.3	1.49	0.6	0.42	0.06
OPC	16.50	67.12	4.58	3.82	1.59	2.98	0.26

Paper Sr. No - 35

Proceedings of the

International Conference on Research Challenges to Multi Disciplinary Innovations

ICRCMI-2021

31st March - 2nd April 2021

ISBN: 978-81-954237-0-5

Organized by

Guru Gobind Singh College of Engineering & Research Centre
Educating with Global Standards
ESTD. : 2013

Guru Gobind Singh College of Engineering and Research Center, Nasik

Proceedings of the International Conference on Research Challenges to Multidisciplinary Innovations

(ICRCMI-2021)

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

GCOERC

Published by Guru Gobind Singh College of Engineering and Research Centre, Khalsa Educational Complex, Indira Nagar Annexe, Wadala-Pathardi Road, Nashik

First Print 2021

Volume 1, Issue 1,
Pages 0001-0339 (2021)

ISBN: 978-81-954237-0-5

The Proceedings of the International Conference on Research Challenges to Multidisciplinary Innovations (ICRCMI-2021) covers a broad range of multidisciplinary subjects in the fields that closely related to present and future forms of technologies. Typically, the proceeding covers various technical reports in the fields of engineering and technology.

More information about this series at https://www.engg.ggsf.edu.in

Publisher:
Guru Gobind Singh Foundation's,
Guru Gobind Singh College of Engineering and Research Centre, Nashik

Chief Editor:

Permindur Singh
Chief Executive Officer
Guru Gobind Singh Foundation, Nashik

Executive Editor:

Dr. Shyamkumar D. Kalpande
Professor, Department of Mechanical Engineering
Mr. Milind S. Patil
Asst. Professor Department of Mechanical Engineering
Guru Gobind Singh College of Engineering and Research Centre, Nashik

Preface

Technological development, need and advances are playing an essential role in compensating various needs of society. Therefore, effective technical solutions should be able to address the long-term issues. Currently, the science and technology of the twenty-first century is relying heavily on the development of new materials, technologies, structures, policies and their implementations. The latest researches directed towards developing systems that are more efficient. The recent trends in technology development decrease the cost, either by introducing the low-cost processing techniques or to increase the efficiency the systems.

In order to deliberate on the current engineering trends and technology development and various industry / society related issues, Guru Gobind Singh College of Engineering and Research Centre has organized "International Conference on Research Challenges to Multidisciplinary Innovations 2021" at Nashik (MS), in association with Indian Institution of Industrial Engineering Mumbai, during the period 31st March 2021 to 2nd April 2021. This conference organized with the aim to provide a platform for researchers and industrialists to promote, share and discuss various issues and developments in the area of engineering and technology.

The purpose and objective of this meeting were also to share the vast knowledge and latest investigations with the scientific industrial community and how to include them in the production to get more efficient systems.

GCOERC

Dear Colleagues and ICRCMI Friends, On behalf of the Technical Program Committee and Organizing Committee, it is a great pleasure for me to announce that the 2nd International Conference on Research Challenges to Multidisciplinary Innovations - ICRCMI 2021 conference was held on-line from 31st March 2021 to 2nd April, 2021. The Faculty of Civil, Computer, Electrical and Mechanical Engineering, GCOERC Nashik and Indian institute of Industrial Engineering (IIIE) jointly organized the Conference. After deep considerations and wishes of the whole organization team for doing it live at least in some form, we found that the only responsible behavior of organizers is to move ICRCMI 2021 to a virtual on-line conference. The decision based on safety issue and we believed that we could handle it by using the measures to reduce the risks to minimum.

As to the earlier ICSESD Conferences held at Bangkok, many authors from institutions all over the Asia and India submitted their papers. This year, 60 papers accepted for on-line presentation. I hope that all participants had taken opportunities not only to exchange their knowledge, experiences and ideas but also to make contacts and establish further collaboration. I hope that we will meet live again at the next ICRCMI / ICSESD Conference series.

Prof. Dr. Permidur Singh

Chief Editor, ICRCMI 2021

GCOERC

The year 2021 represents a significant milestone in the history of engineering community with the organization of the International Conference at the Guru Gobind Singh College of Engineering and Research Centre, Nashik campus during March 31 to April 02 2021. A large number of delegates from different premier academic and research institutions have participated and shared their research experiences at the conference. In all two keynote lectures and 60 contributed papers presented at the conference. The topics covered range from all the fields of engineering, science and technology.

The conference has helped in bridging researchers working at different institutions to share their knowledge and helped in motivating young researchers working for their doctoral program. This has also given some clear directions for further research from the deliberations of the conference. Several people have contributed in different ways for the success of the conference. We thank the keynote speakers and all the authors of the contributed papers, for the cooperation rendered to us in the publication of the conference proceedings. In particular, we would like to place on record, the expert reviewers who have spared their time for reviewing the papers. We also highly appreciate the assistance offered by many volunteers in the preparation of the conference proceedings.

Prof. Dr. Shyamkumar Kalpande.

Executive Editor, ICRCMI 2021

ICRCMI - 2021

31st March to 2nd April 2021

Inaugural Function

Time	Activity
Day – I, Date – 31/03/2021	
11:00 to 11:15 am	Welcome Address by Respected Dr. N. G. Nikam, Principal Guru Gobind Singh College of Engineering and Research Centre, Nashik
11:15 to 11:30 am	Motivational Address by Hon'bl Chief Executive Officer, Dr. Permindur Singh, Guru Gobind Singh Foundation, Nashik
11:30 to 11:50 am	Editorial Address and Introduction of Guest by Vice Principal & Academic Dean Dr. S. D. Kalpande Guru Gobind Singh College of Engineering and Research Centre, Nashik
11:50 to 12:15 am	Address by Hon'bl Chief Guest of the Symposium Dr. M. J. Sable, Professor, Mechanical Engineering Department, College of Engineering Pune
12:15 to 01:00 pm	Keynote Address by Dr. N. P. Gulhane, Professor, Department of Mechanical Engineering V. J. T. I. Mumbai
01:00 to 1:10 pm	Vote of thanks by Executive Editor Mr. M. S. Patil, Department of Mechanical Engineering, Guru Gobind Singh College of Engineering and Research Centre, Nashik

ICRCMI - 2021

31st March to 2nd April 2021

Technical Sessions

Time	Activity
Day – I, Date – 31/03/2021	
02:00 to 05:00 pm	**Track – Mechanical Engineering** Session Chairman: 1) Dr. S. H. Wankhade – Evangelist TRIZ Association of Asia, Pune 2) Dr. C. D. Mohod – Professor and Head Department of Mechanical Engineering Guru Gobind Singh College of Engineering and Research Centre, Nashik
Day – II, Date – 01/04/2021	
11:00 to 01:00 pm	Keynote Address by 1) Dr. Tamal Banerjee, Professor, Department of Chemical Engineering, I. I. T. Guwahati 2) Dr. R. C. Gupta Professor, Department of Mechanical Engineering S. G. S. I. T. S. Indore
01:00 to 02:00 pm	Lunch Break
02:00 to 05:00 pm	**Track – Civil Engineering** Session Chairman: 1) Dr. Amol B. Sane, Matoshri College of Engineering & Research Centre, Nashik (Maharashtra) 2) Dr. V. M. Natraj, Professor and Head Department of Civil Engineering Guru Gobind Singh College of Engineering and Research Centre, Nashik
02:00 to 05:00 pm	**Track – Electrical/ Electronics and Telecommunication Engineering** Session Chairman: 1) Dr. Pankaj G. Vispute, Principal, Shatabdi Institute of Engineering and Research, Agaskhind 2) Dr. S. P. Sonar, Head Department of Electrical Engineering Guru Gobind Singh College of Engineering and Research Centre, Nashik

ICRCMI - 2021

31st March to 2nd April 2021

Technical Sessions

Time	Activity
Day – III, Date – 02/04/2021	
11:00 to 01:00 pm	**Track – Computer Engineering** Session Chairman: 1) Dr. N. S. Choubey, Professor and Head Department of Computer Engineering, M.P.S.T.M.E, NMIMS Shirpur 2) Mr. S. G. Shukla Head Department of Computer Engineering Guru Gobind Singh College of Engineering and Research Centre, Nashik
11:00 to 01:00 pm	**Track – Production & Industrial Engineering** Session Chairman: 1) Dr. L. K. Toke, Associate Professor, Department of Mechanical Engineering, Sandip Institute of Engineering and Management, Nashik 2) Dr. H. A. Chavan, Department of Mechanical Engineering, MET's Institute of Engineering, Nashik
01:00 to 02:00 pm	Lunch Break
02:00 to 03:00 pm	Valedictory Function

Guru Gobind Singh Foundations

Guru Gobind Singh College of Engineering & Research Centre, Nashik

International Conference on Research Challenges to Multidisciplinary Innovation

Index

44	PID008	A Review Paper on Machine Learning Techniques Applied for Intrusion Detection to identify Attacks on KDD99 Data	Suwarna Bokade , Roshani Junghare,Neha Dhumane, Shrawani Tawale,Nitin Mohurle, Rashmi Ghate	313-318
45	PID038	Health Proctoring and diet management using android application	Pooja Kathane,Mrunali Nawale Shivani Burghate,Punam Daigawhane,Krishna, Chaudhari, Ashish Dandekar	319-322
46	PID048	Application of Computational Intelligence in Computer Security	Sandeep G. Shukla,Vishwas M Gaikwad	323-326
47	PID053	Monitoring the Alone Living Elderly People at Home using Surveillance System	Pranali Andraskar,Pratiksha Watkar,Vaishali Gajabe,Nehal Kathale,Shivaji Vee,A. N. Thakare	327-331
48	PID061	Digital Scale for Depression Detection Using Machine Learning	Nitin Choubey,Santosh Bothe, Krisha Mehta	332-335
49	PID069	A Review of Design and develop an efficient pilot-reuse scheduling algorithm to reduce pilot contamination in Massive MIMO systems	Ratnaprabha B Chavan,, Mortha Sureshkumar	336-339

Proceedings of the International Conference on Research Challenges to Multidisciplinary Innovations (ICRCMI-2021)

Track 1: Mechanical Engineering

Performance Assessment of Parabolic Trough Collector Receiver With Al_2O_3 Nanofluid

[1]Milind S. Patil, [2]Sanjay P. Shekhawat

[1, 2]Department of Mechanical Engineering, S. S. B. T's College of Engineering and Technology, Bambhori, Jalgaon (MS) 425 001, INDIA

Abstract: *This paper discusses the experimental and theoretical performance of a parabolic trough receiver using a nanofluid. Main aim of this work is to analyze the performance enhancement of the parabolic trough collector system. Thermal model is developed using Engineering Equation Solver (EES). The developed model was analyzed with a volume flow rate of water as 10 L/min and range of inlet temperature of water from 0 to 45 ^{O}C, also the volume fraction of Al_2O_3 nano particle was varied from 1% to 5%. Experimental analysis was also conducted using nano particle. Results are compared and observed that the model has very good acceptance with the experimental results. It is observed that the thermal efficiency of the collector is increase by 2 to 4% and receiver heat loss is decreased from 0.82% to 2.72%. The receiver outlet water temperature was increased nearly by 10% for the range of volume fraction of Al_2O_3 nano particle.*

Key Words: Parabolic Trough Collector; Nanofluid; Heat Transfer; Thermal Analysis

Nomenclature

ANI	Aperture normal irradiance (W/m^2)
A_a	Aperture area (m^2)
A_r	Receiver area (m^2)
A_{ir}	Inside cross sectional area of the absorber tube (m^2)
C_p	Specific heat (kJ/kg.K)
D_{ci}	Inner diameter of a glass cover (m)
D_{co}	Outer diameter of a glass cover (m)
D_i	Inner diameter of absorber tube (m)
DNI	Direct normal irradiance (W/m^2)
D_o	Outer diameter of absorber tube (m)
HTF	Heat transfer fluid
k_c	Thermal conductivity of a glass cover
L	Collector length
Q_{abs}	Solar radiation absorb by the receiver tube
Q_u	Net energy transfer to the HTF inside the receiver tube
T_a	Ambient Temperature
T_i	Receiver inner surface temperature
T_{co}	Outer surface temperature of a glass cover
T_{ci}	Inner surface temperature of a glass cover
T_{fi}	HTF temperature at inlet of the receiver

T_{fm}	Mean fluid temperature
T_{sky}	Sky temperature
Wa	Paraboloa's aperture width
nf	Nanofluid

Greek Letters

α_c	Absorptance of receiver surface coating
γ	Intercept Factor
σ	Stephan Boltzmann's Constant (5 x 10^{-8} W/m^2.K^4)
$\emptyset$	Latitude location of the solar field
μ	Absolute viscosity of heat transfer fluid
$\eta_{optical}$	Optical efficiency
$\eta_{thermal}$	Thermal collector efficiency
θ	Angle of Incidence
θ_z	Zenith Angle
ρ_{cl}	Clear mirror reflectivity
ρ_{nf}	Density of nanofluid
ρ_{bf}	Density of basefluid
τ	Transmittance of glass cover
ε_{ci}	Emittance of glass cover inner surface
ε_{co}	Emittance of glass cover outer surface
ε_r	Emittance of receiver

I. INTRODUCTION:

High energy cost, fossil fuel depletion and a global warming these are the issues that attracted many of the researchers towards the use of renewable energy [1]. Many researchers are focusing on the various ways of enhancing the performance of solar systems. Free and abundant availability of solar energy is very much useful for heat production [2]. Parabolic trough collectors are made of a sheet of a parabolic shape. Such a sheet is highly reflective and points all incoming solar radiation on the central receiver tube as shown in the Fig. 1. Working fluid flows through the central receiver tube and absorbs the heat energy focused by the parabolic sheet. For a better efficiency and minimum loss this central receiver tube is covered with a glass tube. Various methodologies are suggested to improve the performance of parabolic trough collector including the use of nanoparticles [3, 4]. Sahin et. al. conducted the experimental analysis using Al_2O_3 / H_2O base fluid with a volume fraction ranging from 0.5% to 4%. It is observed that for constant heat flux conditions higher heat transfer is observed for a Reynold number of 8000 and volume fraction of 0.5% [5].

Working fluid used in the receiver of the parabolic trough collector is an important to enhance the thermal performance. Hence the aim is to increase the thermal conductivity of working fluid. Arani et. al. conducted experimental analysis of a PTC using TiO_2/H_2O nanofluid a volume fraction of 0.01 and 0.02% and different sizes of the nano particles. It is observed that the performance of a PTC was maximum for a size of 20nm [6]. Kayhani et. al. also conducted the experimental analysis using TiO_2/H_2O nanofluid and reported that the Nusselt number was improved by 8% which is the main reason for higher performance of PTC compared with water as a working fluid [7]. Masuda et. al. [8] reported an experimental analysis for a nano fluids with a volume fraction of 1.4 to

4.3%. It is observed that the performance was enhanced by nearly 32%. Use of nanofluids is one approach to enhance the performance of the PTC among many other approaches. Winter water heating, cleaning of farm products like potatos and other fruit vegetables; heating and drying of farm products like grapes drying, onion drying etc. are the processes performed by the rural farmers. Some of the processes like production of banana chips and potato chips need a hot water. For all such application PTC will useful since it works on renewable energy source and there is no need to rely on conventional sources. Author belongs to the rural area and observed them from a childhood. Hence main aim of this analysis was to obtain the performance of a PTC using nanoparticles of various volume fractions. Such mathematical analysis will be then useful to decide the dimensions of the PTC setup for heating and drying application of the farm products. While developing this mathematical model heat transfer between fluid to receiver, receiver to cover and loss to surrounding are considered to have a good prediction of outlet water temperature.

II. MATHEMATICAL MODEL

Parabolic Trough Collector:

Simplest design of a solar parabolic trough collector consist of the parts like parabola shape structure, mirrors or reflective surface, tracking system and central receiver tube as illustrated in Fig. 1. Reflective material sheets are bending to form the parabolic shape. Receiver is placed at the focal point and all the sun rays falling on the parabola are reflected towards the receiver. Receiver is covered with a glass tube to reduce the loss of heat energy due to convection and the radiation [9]. Evacuated receiver with Glass cover is used to minimize the heat loss.

For this analysis dimensions of the model are selected similar to the LS2 type PTC using Al_2O_3 nanoparticles mixed with water as a base fluid. PTC under study has a concentration ratio of 22.74 and an aperture area of 39 m^2 [9]. Other details of the PTC are explained in table 1.

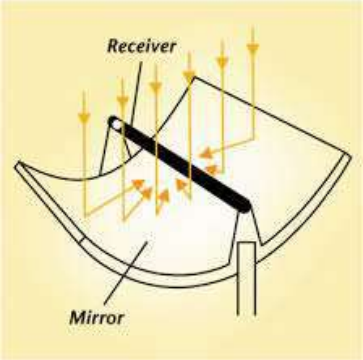


Fig. 1 Parabolic Trough Collector

Table 1: Technical specifications of the PTC system for thermal modeling [9]

Parameter	Symbol Used	Dimensional details
Width	W	5.0 m
Length	L	7.8 m
Focal distance	F	1.84 m
Aperture	A_a	39.0 m^2
Concentration ratio	C	22.74
Absorber inner diameter	D_{ri}	$66 \cdot 10^{-3}$ m
Absorber outer diameter	D_{ro}	$70 \cdot 10^{-3}$ m
Cover inner diameter	D_{ci}	$109 \cdot 10^{-3}$ m

Cover outer diameter	D_{co}	$115 \cdot 10^{-3}$ m
Cover emittance	ε_c	0.86
Cover transmittance	τ	0.95
Absorber absorbance	α	0.96
Concentrator reflectance	ρ_m	0.83
Intercept factor	γ	~1
Maximum optical efficiency	η_{opt}	0.757

Thermal Model:

This section explains the basic equations used for the development of thermal model of the PTC under consideration. Thermal model is developed using Engineering Equation Solver (EES). This software is selected because it provides many useful specialized functions and equations for the solution of thermodynamics and heat transfer problems. Also software has its own fluid properties laboratory and can be called up while developing thermal model [12].

Thermal efficiency (η_{th}) is the ratio of useful heat (Q_u) to the available solar radiation (Q_s) and the available solar radiation is the product of direct beam radiation (G_b)and aperture area (A_a). This study considers the nominal irradiation level as 1000 W/m^2 because during the winter days when the trial was conducted average soalr radiation varies from 1000 to 1200 W/m^2 [13].

$$\eta_{th} = \frac{Q_u}{Q_s} \quad (1)$$

$$Q_s = G_b \times A_a \quad (2)$$

Useful heat energy, energy absorb is represented as

$$Q_u = \dot{m} c_p (T_{out} - T_{in}) \quad (3)$$

$$Q_u = h A_{ri} (T_r - T_{fm}) \quad (4)$$

Where, T_{fm} is the mean fluid temperature given by the equation

$$T_{fm} = \frac{T_{out} - T_{in}}{2} \quad (5)$$

Heat loss from the collector is estimated by the equation 6 and 7

$$Q_{loss} = \frac{A_{ro}\sigma\left(T_r^4 - T_c^4\right)}{\frac{1}{\varepsilon_r} + \frac{1-\varepsilon_c}{\varepsilon_c}\left(\frac{A_{ro}}{A_{ci}}\right)} \quad (6)$$

$$Q_{loss} = A_{co} h_{air} (T_c - T_{am}) + A_{co}\sigma\varepsilon_c (T_c^4 - T_{sky}^4) \quad (7)$$

Since the analysis considers the steady state conditions thermal losses as explained above are considered as a same. In the above equation ambient temperature is considered as 300 K and the sky temperature is estimated by the equation 8.

$$T_{sky} = 0.0553 T_{am}^{1.5} \quad (8)$$

Convective heat transfer coefficient is estimated using equation 9 with a wind velocity of 1 m/s, which is nearly 10 W/m^2.K

$$h_{air} = 4. V_{wind}^{0.58} . D_{co}^{-0.42} \quad (9)$$

Using an energy balance net heat received must be equal to the sum of heat utilized and heat loss and the equation can be established as

$$Q_s\eta_{opt} = Q_u + Q_{loss} \quad (10)$$

Heat transfer coefficient for the absorber fluid is calculated using Nusselt number. For turbulent flow Dittus-Boelter equation 11 was used and heat transfer coefficient is calculated using equation 12.

$$N_u = 0.023R_e^{0.8}P_r^{0.4} \quad (11)$$

$$N_u = \frac{hD_{ri}}{k} \quad (12)$$

$$R_e = \frac{4\dot{m}}{\pi D_{ri}\mu} \quad (13)$$

$$P_r = \frac{\mu c_p}{k} \quad (14)$$

Thermal Properties of the Nanofluid:

For this analysis Al_2O_3 nano particles are selected because of easy availability in nearby locations of the study. Table 2 represents the summary of the properties of the selected nano particles

Table 2: Properties of the nanofluid [9]

Property	Symbol Used	Value	Unit
Density	ρ	3960	kg/m^3
Specific Heat	c_p	773	*kJ/kg.K*
Thermal Conductivity	κ	40	*W/m.K*

Properties of the nanofluid are calculated based on the volume fraction of the nano particle (ϕ). Equation 15 to 18 are used to estimate density, specific heat, thermal conductivity and viscosity

$$\rho_{nf} = \rho_{bf}(1-\phi) + \rho_{np}\phi \quad (15)$$

Khanafer and Vafai [10] conducted thermo-physical characterization for the nanofluids and suggested the formula for the calculation of specific heat of the nanofluids.

$$c_{pnf} = \frac{\rho_{bf}(1-\phi)}{\rho_{nf}}c_{pbf} + \frac{\rho_{np}\phi}{\rho_{nf}}c_{pnp} \quad (16)$$

Duangthongsuk and Wongwises [11] suggested the equation for calculating the thermal conductivity of the nanonfluid.

$$k_{nf} = k_{bf}\left[\frac{k_{np}+2k_{bf}+2(k_{np}-k_{bf})(1+\beta)^3\phi}{k_{np}+2k_{bf}-(k_{np}-k_{bf})(1+\beta)^3\phi}\right] \quad (17)$$

$$\mu_{nf} = \mu_{bf}(1+2.5\phi+6.2\phi^2) \quad (18)$$

Above equations are then used for performance analysis as well as solving the mathematical model. Input parameters used are defined in table 1, 2 and 3

III. PTC TEST SETUP

Solar parabolic trough converts solar energy in to thermal energy. This thermal energy is then used to heat the heat transfer fluid passing through the receiver tube located at the focus of the collector. Parabolic shaped reflector is metal sheet covered with the highly reflective material. The reflected solar radiation is then concentrated on the receiver. The geometry of the parabolic trough collector includes rim angle, concentration ratio, focal length, collector length, receiver tube diameters etc.

Rim Angle ∅ is the angle between optical axis and the collector axis and is give by the equation

$$\sin(\emptyset) = \frac{w_a}{2r}$$

Where w_a the aperture width and r is is the radius of the parabola

Focal length is the distance between the focal point and the collector rim, given by the equation

$$f = \frac{w_a}{4\tan\left(\frac{\emptyset}{2}\right)}$$

Concentration ratio is the ratio of collector aperture area and the receiver surface are. It is given by the equation

$$C = \frac{w_a}{\pi d_o}$$

Where d_o is the receiver outer diameter

Based on the above parameters a small size PTC system was manufactured with the specifications as represented in the table 2. The reflector is made of mirror finished stainless steel sheet with 86% reflectivity. Receiver is coated with matte black paint with absorptivity 0.9. Receiver is covered with concentric acrylic tube with an annulus gap of 1.6 cm. The acrylic material has higher transmissivity and stronger than glass. The PTC system as shown in the Fig. is located at the Dhule. The system is set at North – South axis and provided with manual tracking. Experiments were conducted in the month of Jan 2021. The heat transfer fluid was selected as water.

Table 2: Specifications of the PTC system

Parameter	Symbol Used	Dimensional details
Width	Wa	1.6 m
Length	L	2.5 m
Focal distance	f	0.486 m
Rim angle	∅	80°
Absorber inner diameter	D_{ri}	0.0224
Absorber outer diameter	D_{ro}	0.0254
Cover emittance	ε_c	0.86
Cover transmittance	τ	0.95
Absorber absorbance	α	0.9
Concentrator reflectance	ρ_m	0.83
Intercept factor	γ	~1

IV. RESULTS AND DISCUSSION

Equations 1 to 18 are used in development of thermal model using an engineering equation solver. Base fluid is selected as water and nanoparticle selected for study is Al_2O_3. For the present study concentration of these nanoparticles was varied from 1% to 5%. Water inlet temperature was varied from 0 to 45°C since the temperature water varies in these limits during the seasonal changes.

Analysis was conducted for water volume flow rate of 10 L/min as overhead tanks constructed in the farms delivers the water with nearly same rate.

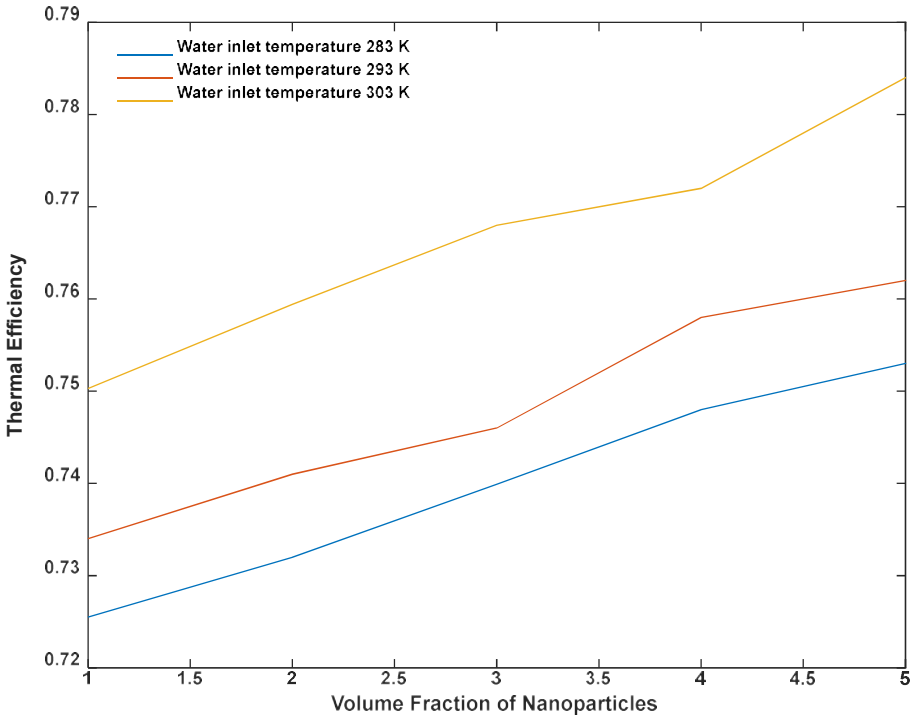


Fig. 2 Effect of volume concentration of Nanomaterials on thermal efficiency

Fig. 2 represents effect of volume concentration of nano particles over thermal efficiency of the concentrator. It is observed that for the fixed water inlet temperature and flow rate thermal efficiency almost increases linearly with increase in volume concentration from 1% to 5%. With increase in volume concentration of nanoparticles from 1% to 5% at water inlet temperature of 293K, thermal efficiency increase from 1.90% to 5.79%. It is also observed that with increase in inlet temperature thermal efficiency decrease from 0.72% at 10^{O}C to 4.16% at 30^{O}C for a volume concentration of 1%. Rate of increase in thermal efficiency is higher for a concentration 4% to 5% at high temperature. Hence it is recommended to use nanofluids for higher water inlet temperature. Enhancement in thermal efficiency is observed due to the fact that the thermal conductivity of nanofluid increases with increase in volume concentration of the nanoparticles. Fig. 3 indicates variation in thermal conductivity of the nanofluid with change in volume concentration of the nanoparticles. Hence it would be better to observe or compare performance of various nanofluids for same operating conditions. It is always better to select the nanofluids of higher thermal conductivity of higher thermal efficiency.

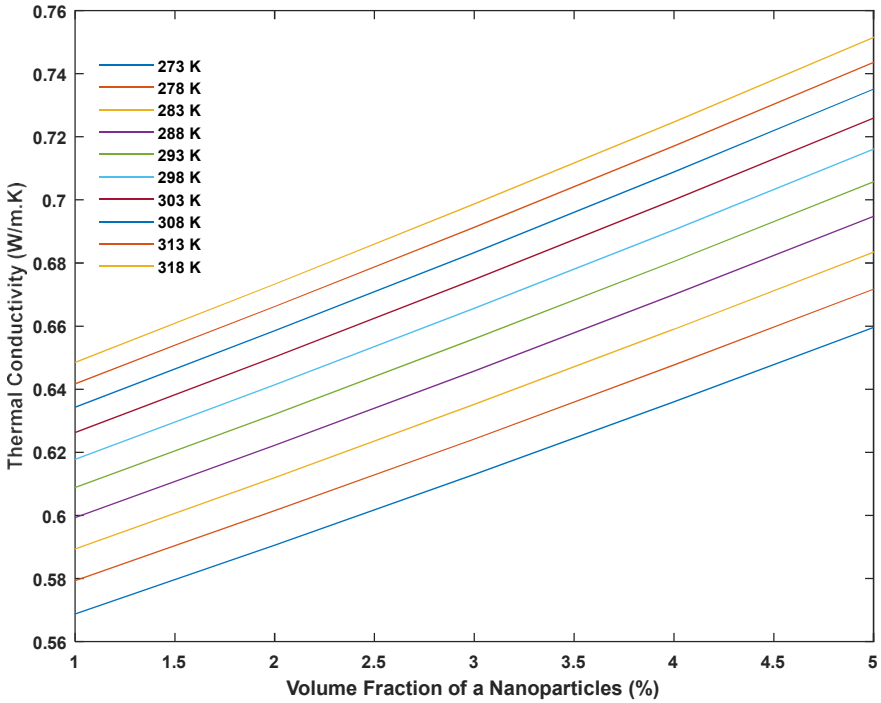


Fig. 3 Effect of volume fraction of nanoparticles on thermal conductivity of nanofluids

Fig. 4 represents the receiver exit water temperature. Main objective is to enhance the water temperature because this heated water would then use for many application. It is observed that temperature of water increases almost linearly. For a water inlet temperature of $0^{O}C$ rise in temperature is observed from 3 to 16% with increase in volume fraction of nanoparticle from 1 to 5%. However for higher inlet water temperature rise is observed to from 2 to 8% this is due to the fact that with increase in temperature of the receiver heat loss increases as represented in Fig. 5 and 6. It is observed that for the inlet water temperature of $20^{O}C$ receiver heat loss increases from 0.82% to 2.71% as volume fraction of naoparticle increases from 1 to 5%.

Fig. 7 represents percentage change in receiver water outlet temperature; it is observed that as volume fraction of nanoparticle increase from 1 to 3% receiver outlet temperature increase by 3 to 4% only. For higher volume fraction of nanoparticle (4 to 5%), water outlet temperature increase by 8 to 16%. Increase in water temperature is observed even there is an increase in heat loss this is because of higher heat transfer coefficient. It is observed that HTC increases linearly from 1.8 to 8.4 %.

Useful heat gain for receiver water is represented in Fig 8. It is observed that for a lower water inlet temperature from 0 to 15 heat gain is increased and observed as high for 5% of nanoparticle volume fraction. With increase in water inlet temperature above $25^{O}C$ it decreases rapidly. This is because of the fact that the specific heat of the nanofluid decrease as represented by Fig. 9.

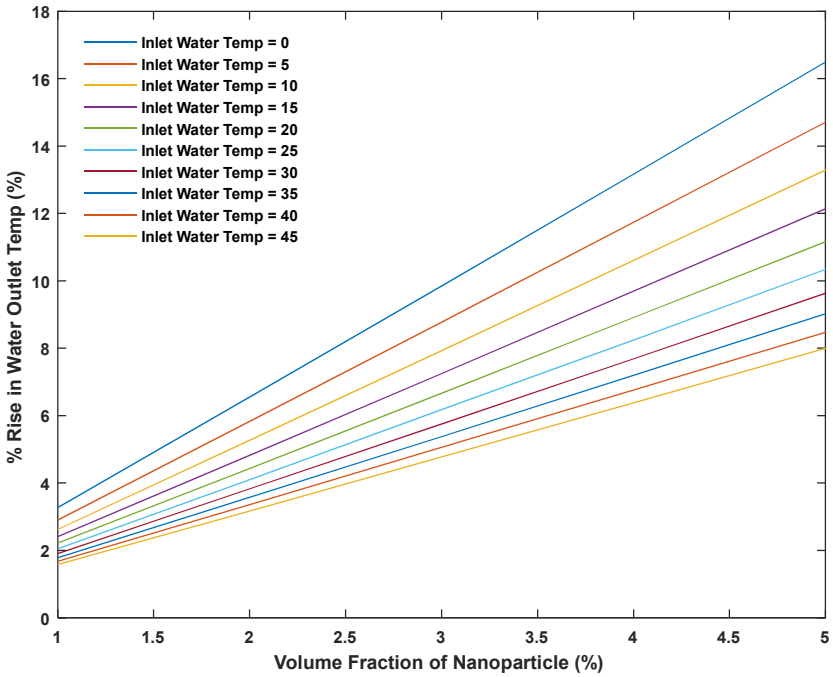


Fig. 4 Effect of volume fraction of the nanoparticle on receiver water outlet temperature

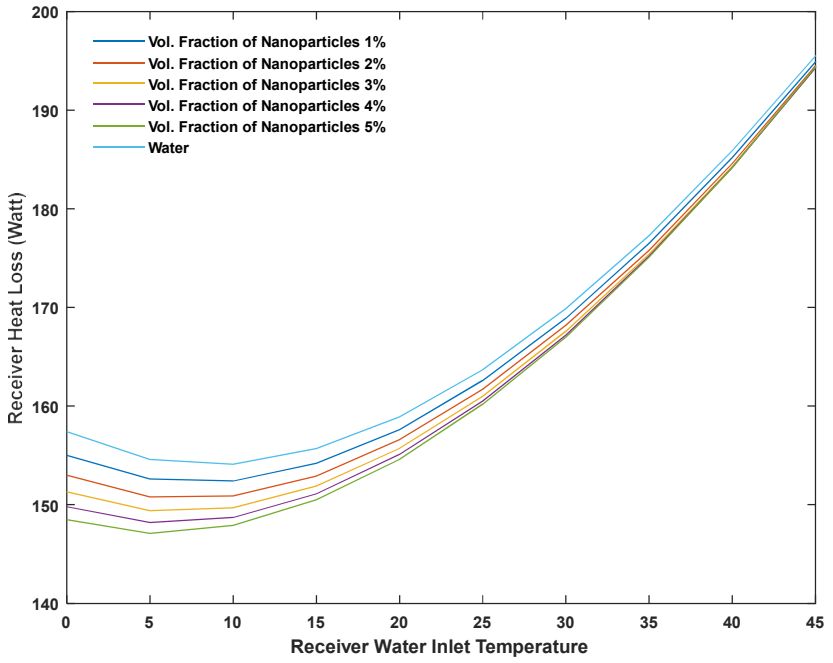


Fig. 5 Effect of volume fraction of the nanoparticle on the receiver heat loss

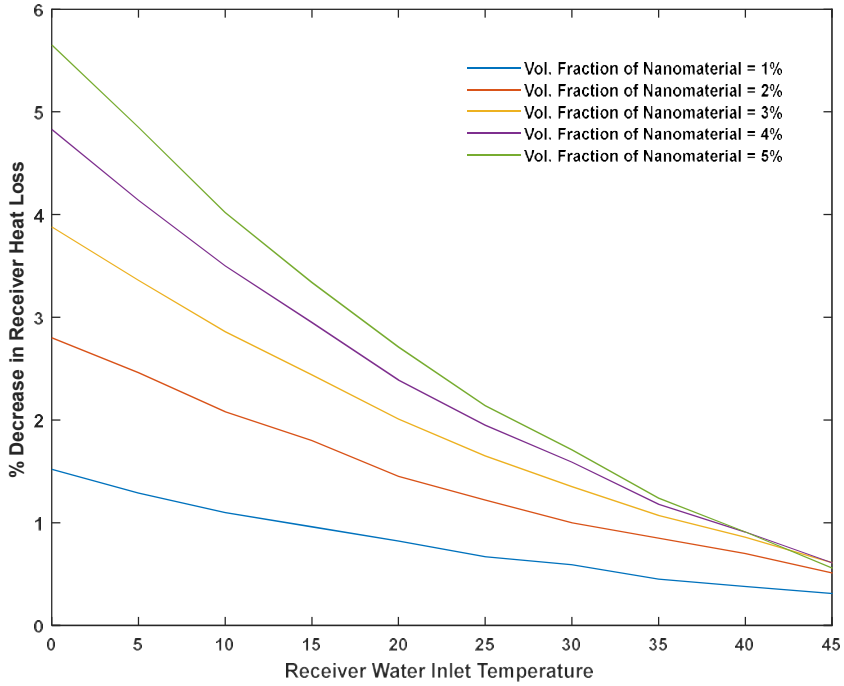


Fig. 6 Effect of volume fraction of the nanoparticle on receiver heat loss

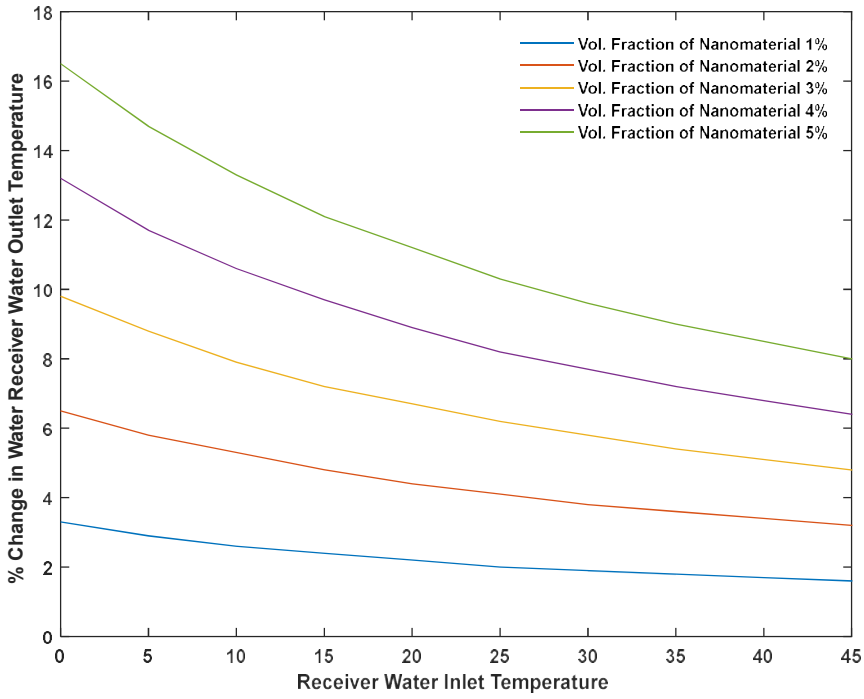


Fig. 7 Effect of Volume fraction on receiver water outlet temperature

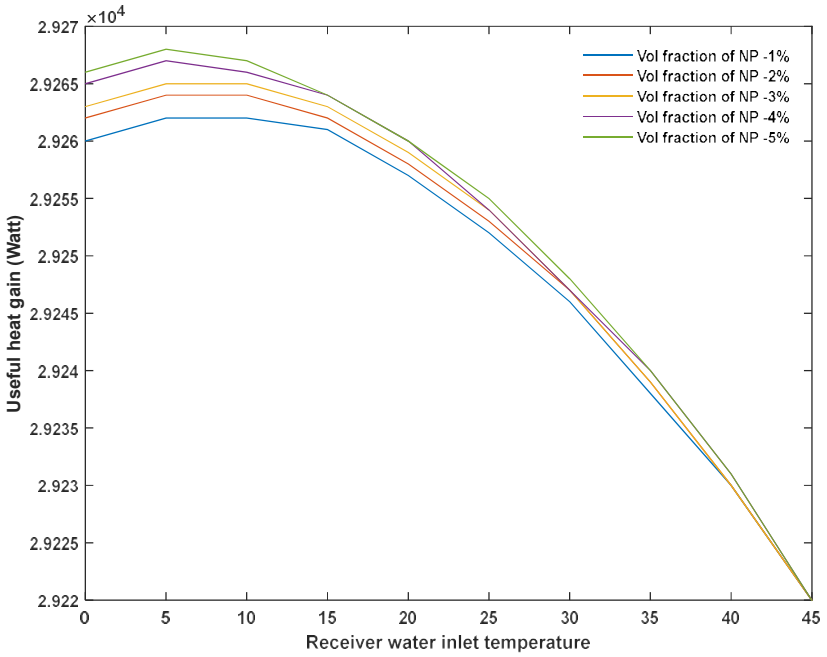


Fig. 8 Effect of Volume fraction on receiver useful heat gain

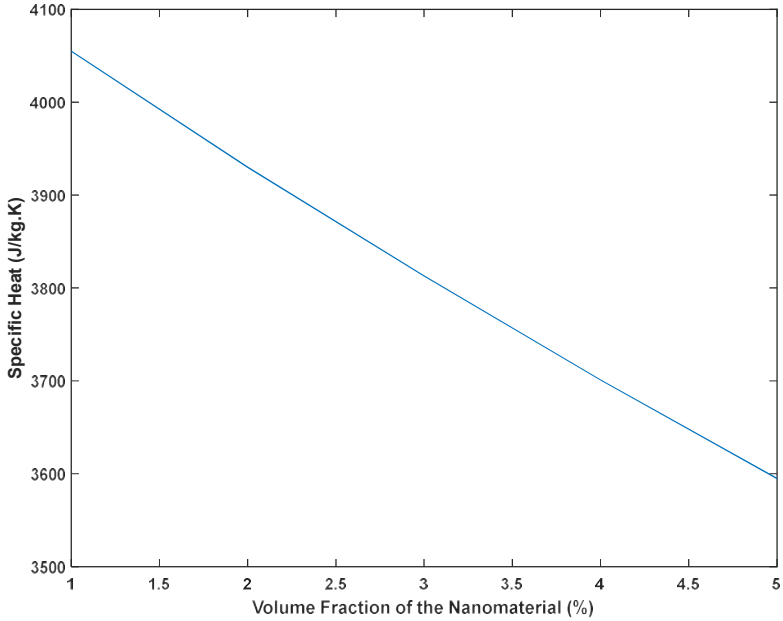


Fig. 9 Effect of volume fraction of the nanoparticle on the specific heat of nanofluid

V. CONCLUSIONS:

Thermal model is developed using Engineering Equation Solver (EES). The developed model was analyzed with a volume flow rate of water as 10 L/min and range of inlet temperature of water from 0 to 45 ^{O}C, also the volume fraction of Al_2O_3 nano particle was varied from 1% to 5%. Following are the conclusions of this study

- PTC performance improvement by using nanofluids, hence high water temperature will be obtained for farm applications like vegetable cleaning and other agricultural products
- 2 to 4% more energy is available by using 5% of Al_2O_3 water base nanofluid

- For a water inlet temperature of 293K, thermal efficiency increase from 1.90% to 5.79%. Rate of increase in thermal efficiency is higher for nano particle concentration 4% to 5% at high temperature. Hence it is recommended to use nanofluids for higher water inlet temperature.
- For the inlet water temperature of $20^{O}C$ receiver heat loss increases from 0.82% to 2.71% as volume fraction of nano particle increases from 1 to 5%.
- Increase in water temperature is observed even there is an increase in heat loss this is because of higher heat transfer coefficient. It is observed that HTC increases linearly from 1.8 to 8.4 %.

REFERENCES

[1] E. Bellos, D. Korres, C. Tzivanidis, K.A. Antonopoulos, Design, simulation and optimization of a compound parabolic collector, Sustainable Energy Technologies and Assessments 2016; 16:53-63

[2] W.G. Le Roux, T. Bello-Ochende, J.P. Meyer, A review on the thermodynamic optimisation and modelling of the solar thermal Brayton cycle, Renewable and Sustainable Energy Reviews 2013;28:677-690

[3] D. Lei, Q. Li, Z. Wang, J. Li, and J. Li, "An experimental study of thermal 493 characterization of parabolic trough receivers," Energy Conversion and Management, vol. 69, pp. 107-115, 2013.

[4] P. M. Zadeh, T. Sokhansefat, A. Kasaeian, F. Kowsary, and A. Akbarzadeh, "Hybrid 505 optimization algorithm for thermal analysis in a solar parabolic trough collector based on nanofluid," Energy, vol. 82, pp. 857-864, 2015

[5] B. Sahin, G.G. Gultekin, E. Manay, S. Karagoz, Experimental investigation of heat transfer and pressure drop characteristics of Al_2O_3-water nanofluid, Exp. Therm. Fluid Sci. 50 (2013) 21–28. doi:10.1016/j.expthermflusci.2013.04.020.

[6] A.A. Abbasian Arani, J. Amani, Experimental investigation of diameter effect on heat transfer performance and pressure drop of TiO2-water nanofluid, Exp. Therm. Fluid Sci. 44 (2013) 520–533. doi:10.1016/j.expthermflusci.2012.08.014

[7] M.H. Kayhani, H. Soltanzadeh, M.M. Heyhat, M. Nazari, F. Kowsary, Experimental study of convective heat transfer and pressure drop of TiO 2/water nanofluid Int. Commun. Heat Mass Transf. 39 (2012) 456–462. doi:10.1016/j.icheatmasstransfer.2012.01.004

[8] Masuda H, Ebata A, Teramae K, Hishinuma N. Alteration of thermal conductivity and viscosity of liquid by dispersing ultrafine particles (dispersion ofc-Al2O3, SiO2, and TiO2 ultra-fine particles). Netsu Bussei 1993; 4:227–33.

[9] Evangelos Bellos, Christos Tzivanidis, Thermal efficiency enhancement of nanofluid-based parabolic trough collectors, Journal of Thermal Analysis and Calorimetry, 2018

[10] K. Khanafer, K. Vafai, A critical synthesis of thermo physical characteristics of nano fluids, International Journal of Heat and Mass Transfer 2011;54(19):4410-4428

[11] W. Duangthongsuk, S. Wongwises, An experimental study on the heat transfer performance and pressure drop of TiO2-water nanofluids flowing under a turbulent flow regime, International Journal of Heat and Mass Transfer 2010;53(1-3):334-344

[12] Engineering Equation Solver, S. A. Klein, 1992-2003, by F-chart

[13] Sanjay P Shekhawat and Milind S Patil, Year round thermal performance of solar parabolic trough collector, Solid state technology, 2020; 63(6): 10981-10998

Proceedings of IEEE Third International Conference on Multimedia Processing, Communication & Information Technology – MPCIT 2020
JNNCE, Shivamogga, Karnataka, India

2020 Third International Conference on Multimedia Processing, Communication & Information Technology (MPCIT) |978-1-6654-1987-1/20/$31.00 ©2020 IEEE | DOI: 10.1109/MPCIT51588.2020.9350475

Simulation of Maximum Efficiency Point Tracking in Wireless Power Transfer Systems using Pulse Density Modulation

Urmila Mathure [(1)]
PG Student
Department of Electrical Engineering, G.E.S. R. H.
Sapat College of Engineering,
Management Studies and Research, Nashik, India
urmilamathure28@gmail.com

Dr. R. V. S. Ramkrishna[(2)]
Associate Professor
Department of Electrical Engineering, G.E.S. R. H.
Sapat College of Engineering
Management Studies and Research, Nashik, India,
rk_nedes@yahoo.co.in

***Abstract*- This paper presents a method of control known as maximum efficiency point tracking (MEPT). This method of control is used for wireless power transfer (WPT) systems to provide maximum value of efficiency against load variations and coupling with achieving power demands of the system. In traditional MEPT systems, on both transmitting and receiving sides dc/dc converters are used in order to achieve maximum efficiency and for the regulation of output voltage. But this arrangement increases the complexity of network with increasing power loss. Some implementations lead to new problems likehard switching, large dc voltage ripples and low average efficiency. An implementation of MEPT based on pulse density modulation is explained in this paper which removes all the drawbacks in existing implementation. A PDM circuit is used in both transmitting and receiving side to achieve maximum efficiency. A simulation circuit is built in matlab in this paper to get maximum efficiency. By varying load resistances and pulse densities in the matlab Simulink circuit an efficiency and output voltage is checked By comparing the results of existing MEPT implementation with this simulation circuit of WPT using PDM it achieved efficiency upto 83% for various load resistances and pulse densities.**

***Keywords*—MatlabSimulation, Wireless power transfer (WPT), maximum efficiency point tracking (MEPT),root-mean square (RMS),pulse density modulation (PDM).**

I. INTRODUCTION

In WPT systems, a control method called as maximum efficiency point tracking (MEPT) is used to provide maximum efficiency along with the desired output power. Since in many applications of WPT systems, load resistance and coupling coefficient are varying and uncertain. These two parameters affect on system efficiencyas well as output power. MEPT control strategiesprovide required powerwith maximum efficiency[1]. For WPT systems, MEPT implementations [21] were presented to provide highest efficiency along with desired power [3-9].

DC-DC converters are used in traditional MEPT implementations. These converters are used on transmitting and receiving sides for linear regulation of the output voltage and for conversion of the equivalent load resistance into its optimal valuerespectively. This load resistance is dependent on the coupling [3] which helps for maximization of efficiency.Drawbacks of these implementations are the slow response due to additional dc-dc converters, complexity in system network, hard switching.

In [10], implementations of MEPT control including the phase shift active rectifier presented. In this method, phase-shift control is used in which basically controlling of active bridge converters on both sides is done. Here, dual-side control technique is used formaximization of the system efficiency as well as for regulation of the output power. But this system causes problem of hard switching which is due to the phase-shift. Hard switching is problematic to high frequency applications of WPT systems since the switching can be dominant for the systems. This system is used for low frequency operations and for short distances e.g. dynamic electric vehicle charging [15] and multiple-receiver systems [16].

In [11], implementations of MEPT control uses on-off control. In this type of MEPT control, efficiency and power control at secondary side is achieved. But an efficiency and power control method at only secondary side is done in [12,13] In this system, half bridge active rectifier controls the power flow which operates on short and rectification mode. At the receiving side of this implementation, a conversion of equivalent load resistance into the optimal value of it takes place. This implementation offers advantages like elimination of dc-dc converters at transmitting side and efficiency maximization as well as power regulation at receiving side. But this implementation has some drawbacks. The main

disadvantage of this implementation is low efficiency of the systemsince an efficiency will be zero in short mode and it can be maximized only in rectification mode. Also there are large voltage ripples due to theon off operation at low frequency of active rectifier.

In [14,22], phase shift control and frequency control method is used. In this implementation, load impedance is matched with source impedance for efficiency improvement in wireless power transfer (WPT) system. In this, both phase shiftand frequency of inverter output voltage varies to minimize the input power and an output power will remain constant with the use of dc-dc converter.

For WPT systems,MEPT is appealing control techniquebut current implementations of MEPT are not enough to fulfill all requirements. Hence, this paper presents the implementation of MEPT using pulse density modulation (PDM).

for WPT systems, in order to achieve maximum efficiency point tracking (MEPT), apulse density modulation (PDM) is progressive technology. The regulation of voltage as well as efficiency maximization can be achieved together in the absence of dc/dc converters by using PDM in WPT systems. In previous techniques of MEPT in which PDM is used, PDM was used only at the transmitting side for not only power regulation but also voltage regulation. But in these implementations, maximization of efficiency is not done. This paper shows the implementation with PDM on both the transmitting and receiving side for power and voltage regulation as well as efficiency maximization in WPT system.

II. ANALYTICAL STUDY OF MEPT FOR WPT

Fig.1, represents the traditional MEPT implementation. In this implementation, on both the transmitting and receiving sides dc-dc converters are used.

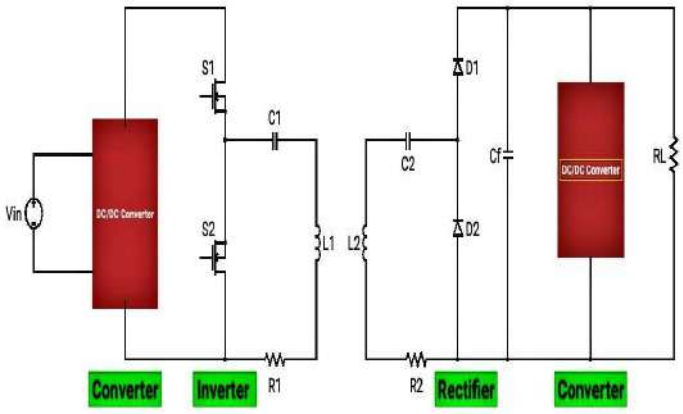


Fig.1: Traditional MEPT implementation of WPT system using dc/dc converters

In [3], WPT system using magnetic resonant coupling theory presents the concept of load matching for efficiency maximization. In this, it shows an operating point where efficiency maximizes. This point has to be tracked in real time because as the load or coupling varies it helps to maximize the efficiency. Similarly, in [2], delta-sigma modulation is used for efficiency maximization. This theory used harmonic ac equivalent circuit with lumped parameters [1] and this theory derives the formulas for figure-of-merit, optimal load as well as maximum theoretical efficiency [2].

Fig.2, shows the fundamental harmonic equivalent circuit model [2], where L_1, R_1, C_1 and L_2,R_2,C_2, representing inductances, equivalent series resistances and capacitances of resonators of side 1 and side 2 respectively. While M represents the mutual inductance of two coupled coils. The equivalent load resistance presented by Re and U_1 represents the fundamental component of load voltage.

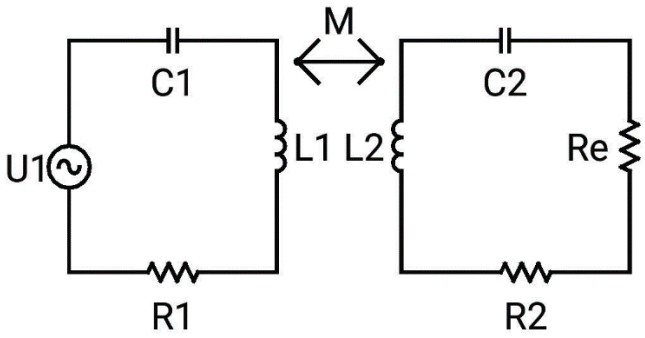


Fig.2: Fundamental harmonic equivalent circuit of WPT

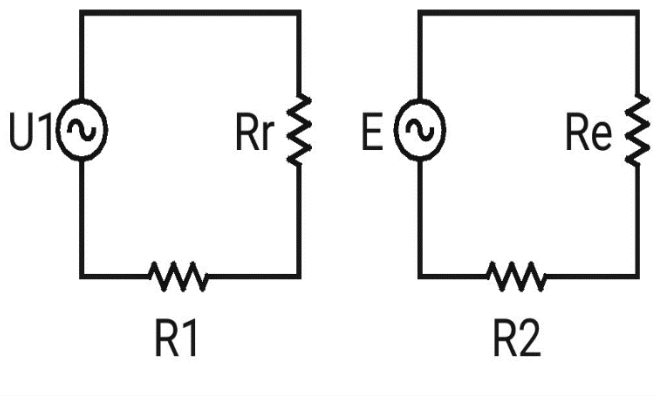


Fig. 3: Decoupled Circuit of harmonic equivalent Circuit of WPT

An essential condition for maximization of efficiency in WPT system is thatthe switching frequency $w_s$and the angular frequencies of the resonators w_1 and $w_2$of two sides need to be equal. That is, when system tuned in resonance,

$$w_s=w_1=w_2 (1)$$

Fig.2, is decoupled and shown as Fig.3 as decoupled circuit [1]. Where, E represents induced voltage and Rr represents reflected resistance.

$$Rr = \frac{(wsM)^2}{R_2+Re} (2)$$

The product between transmitting side efficiency $\eta_1$and receiving side efficiency $\eta_2$results intothe overall power transfer efficiency of the systemi.e.

$$\eta=\eta_1\times\eta_2=\frac{R_r}{R_1+R_r}\times\frac{R_e}{R_2+R_e} (3)$$

$Re_{optimal}$ which maximizes η is found out by:

$$R_{e_{optimal}} = R_2\sqrt{1+fom^2} (4)$$

Where,fom represents figure-of-merit, it is shown by eq. (5), from which it can be said that fom is the function of ωs, M, R_1, and R_2

$$fom = \frac{wsM}{\sqrt{R_1R_2}} (5)$$

Also, maximum efficiency is given as:

$$\eta_{max}=1-\frac{2}{1+\sqrt{1+fom^2}} (6)$$

When the value offom is large, (6) is close to:

$$\eta_{max}=\frac{fom-1}{fom+1} (7)$$

To fulfill the basic and essential condition of maximum efficiencystated in equation (1), $R_{e\text{-optimal}}$ must vary with change in mutual inductance M. As in equation (4) and (5), it can be seen that $R_{e\_optimal}$ is basically function of the equivalent series resistances R_1 and R_2 respectively and mutual inductance M. A process is used for trackingin practical WPT systems for obtaining$R_{e\text{-optimal}}$. The process used for tracking is similar to (MPPT) but an important objective of tracking is maximization of efficiency therefore the tracking stated here can be called as MEPT [3-5].

An actual load resistance is dependent on the user in WPT system therefore system should itself provide a system for the conversion of R_e in its optimal value.

III. ANALYSIS OF PDM FOR MEPT

A. Procedure:

Fig.4, represents basic schematic diagram for dual side active bridge WPT system. A dc input voltageis represented as $v_{in}$and output dc voltage is represented as v_o. Fig 5. shows stationary waveforms of dual-side active bridge WPT system in resonance. In fig.5, it is shown that the transmitting side half-bride inverter generates voltage pulses u_1 which excites the current i_1 which is resonant current of transmitting side. Due to the magnetic coupling, i_1 induces the current in the receiving side rectifier i_2. C_f acts as filtering capacitor as the receiving side rectifier output gets filtered through it. This output then received by R_L. $u_1$and $i_1$are in phase while u_2 and $i_2$are in phase. Similarly,the phase difference between i_1 and i_2 is 90˚ when a system is in resonance.

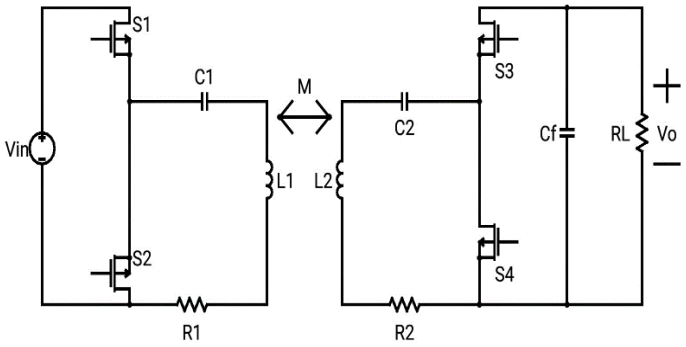
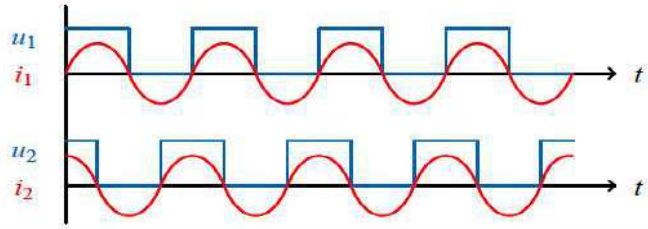
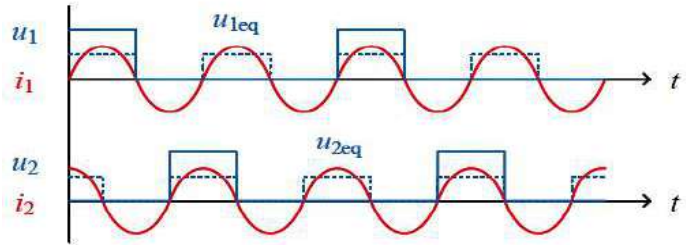


Fig.4: Dual Active Bridge WPT System

Fig.5 represents the basic operating waveforms of WPT system with PDM. Fig. (a) represents the operating waveforms without PDM while Fig. (b) represents operating waveforms with PDM.



(a) Operating waveforms of WPT system without PDM



(b) Operating waveforms of WPT system with PDM

Fig. 5: Basic Operating Waveforms

In general, inverter switches S_1 and S_2 conduct alternatively to continuously generate the pulses u_1. Similarly, rectifier switches S_3 and S_4 conduct alternatively to continuously generate the pulses u_2.But by keeping S_1 off and S_2on, few pulses can possibly be eliminated in a complete switching cycle and similarly it goes for u_2 as few pulses of u_2 may be eliminated with S_3keptoff and S_4 on. Pulse density can be defined as the ratio of remaining pulses numberto the switching cycles number and it is denoted as d[]. Such switching operation is known as pulse density modulation (PDM).

The power transferred from transmitting to receiving side is:

$$P=\omega_S M I_1 I_2 \quad (8)$$

Here, i_1 and i_2 have the root-mean-square (RMS) values which are I_1 and I_2respectively [20].

The mean input power and output power calculated as:

$$P_{in} = \frac{\sqrt{2}}{\pi} v_{in} I_1 (9)$$

$$P_o = \frac{\sqrt{2}}{\pi} v_{io} I_2 (10)$$

In fig.5 (b), solid lines expressing the remaining pulses u_1 and u_2 respectively and dash lines expressing the equivalent continuous pulses u_{1eq} and u_{2eq} which are balanced by u_1 and u_2. Hence for the system using PDM,the mean input power and output poweris given as:

$$P_{in} = \frac{\sqrt{2} d_1 v_{in} I_1}{\pi} (11)$$

$$P_o = \frac{\sqrt{2} d_1 v_o I_2}{\pi} (12)$$

Where, d_1 and$d_2$arepulse densities of u_1 and $u_2$respectively. The equivalent load resistance R_e is calculated based on the power balance principle []. Then R_e can be calculated as:

$$P_o = \frac{v_o^2}{R_L} = I_2^2 R_e \quad (13)$$

There are two control degreesfor the system i.e. $d1$ and $d2$.The d_1 is for power flow control and$d2$ is for the load resistance conversion of the system. In this operation $d1$ and d_2 can exchange their jobs which is mentioned in [3]. Hence, the WPT system with PDM on both sides maximize the system efficiency and regulate the output voltage at the same time.

An essential and initial condition for MEPT with PDM in WPT system is that the PDM pulses of u_1 andu_2 have to be uniformly distributed.

Fig.6, shows a flowchart or algorithm to follow to achieve maximum efficiency in WPT systems using PDM.

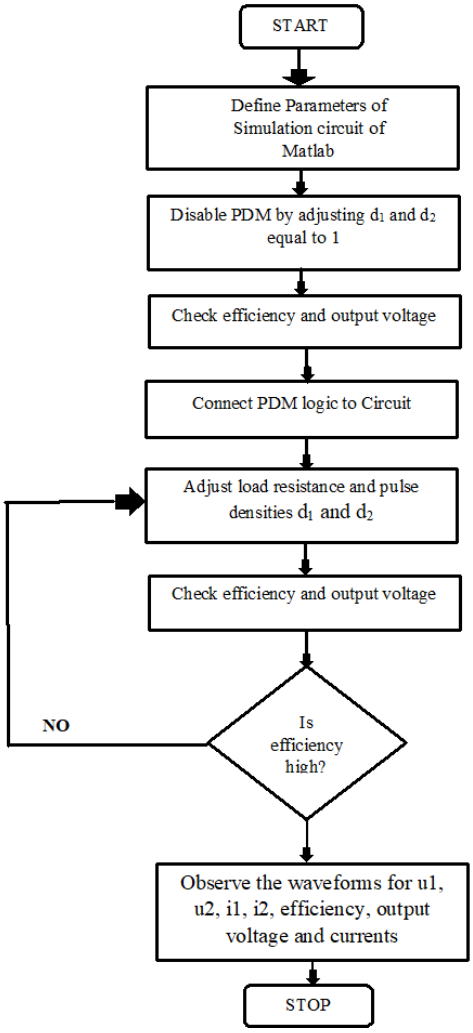


Fig.6. Algorithm to follow for MEPT using PDM

When the values of pulse densities are in the form of fractions then the generated pulses are most uniform [17-19].For MEPT using PDM we have to connect PDM logic to the dual-side active bridge WPT system. This logic is connected on half-bridge transmitting side as well as on half-bridge receiving side.

B. LOGIC OF PDM:

Fig.7, representing the logic of PDM which have to connect to the MEPT with PDM. This drive logic of PDM is connected at both the transmitting and receiving side converters in the matlab simulink model. This logic circuit have three input signals. Out of the three input signals, first input is input pulses having duty cycle of 50%, next input given is the delayed pulses while the last ad third input is*'d'*which is pulse density.An accumulator is activated by the rising edges of input pulses. A function of Accumulator is to accumulate the difference between *'d'* andthe comparator output. Next block

shown in the logic is comparator which rounds off the accumulator output to single digit. Delayed pulses in the logic shows the pulses delayed by the delay specified in the logic. The AND operator combines the delayed pulses output and comparator output. The AND operator's and NOT operator's outputs are the output modulated pulses.

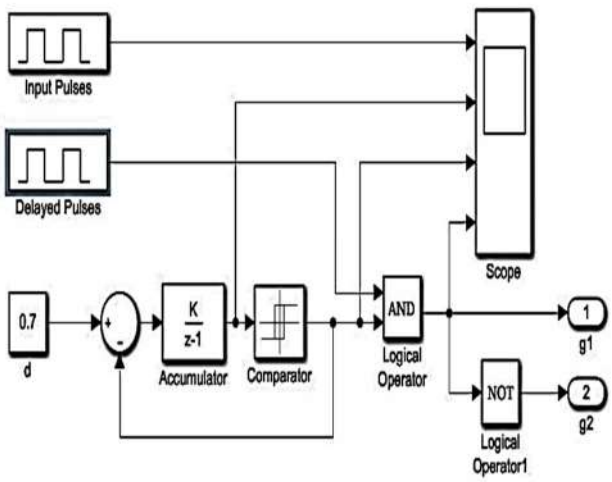


Fig.7: Logic of PDM for maximum efficiency tracking in WPT

Fig.8, shows the PDM logic waveforms at the time of giving input d=0.8. These input pulses are uniformly distributed.

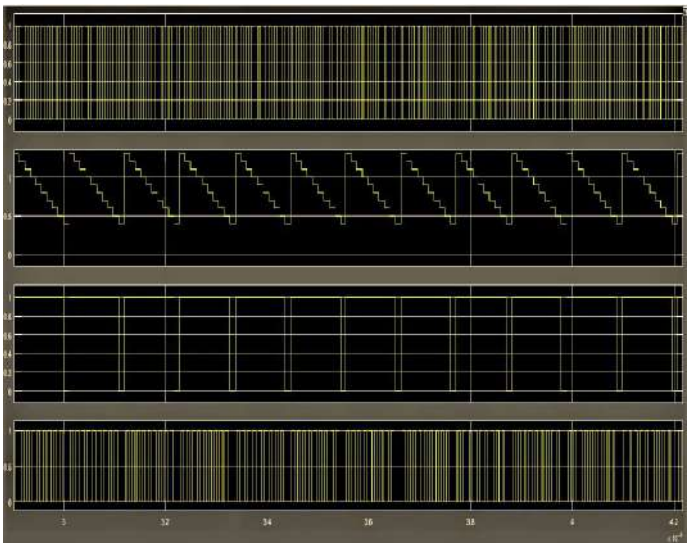


Fig 8: PDM logic waveforms at d=0.8

Fig.9, shows the circuit diagram of implementation of MEPT with PDM drive logic where d_1 is control degree of transmitting sideand d_2 is the control degree of receiving sides respectively.

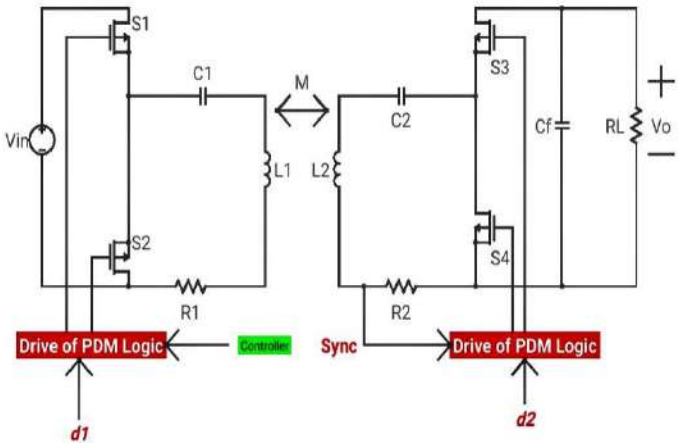


Fig.9: The schematic of proposed MEPT implementation

The equivalent load resistance is function of load resistance R_L and d_2.

$$R_e = \frac{2}{\pi^2} d_2{}^2 R_L \quad (14)$$

The PDM driver is connected not only to the transmitting side half bridge but also receiving side half bridge. A controller generates the transmitting side PDM driver input pulses. If the switching frequency is higher than resonant frequency of transmitting side, then at inverter side soft switching will be accomplish [2]. Similarly, in case of active rectifier it can be accomplished with the synchronization.

IV. SIMULATION

The simulation circuit is designedin matlab as per the schematic shown fig.9 and based on the mentioned Table Iparameters. The switching frequency for the simulation is and the resonant frequency is 0.920 MHZ for resonators on two sides as the values for inductances and capacitances for both sides are same. An input voltage is 40V. For achieving maximum efficiency, the system should be in resonance hence the switching frequency and resonant frequency set to be same. By varying the load resistance and the pulse densities d_1 and d_2 output voltage and efficiency is examined. Fig.10 shows the simulated waveforms of the respective matlab Simulink model of proposed MEPT implementation.

A. Efficiency maximization and Voltage regulation effects in simulation:

The effects on efficiency maximization and voltage regulation in the matlab Simulink model process is described below:

First in the Simulation model, to disable PDM, pulse densities d_1 and d_2 are set at 1. Then the load resistance is set at R_L=25Ω the efficiency dropped at 54%. At R_L=25Ω PM logic is connected to the simulation circuit by varying the pulse densities. Pulse densities d_1 and d_2 are set to 0.56 and 0.53 respectively. It gives the output voltage of 34.45V with increase in system efficiency of 83%. Fig.(a) shows the u_1, u_2, i_1, i_2 of system when. Fig.(b) represents the waveforms of output current and output voltage of the matlab Simulinkmodel.

Now R_L is manually increased to 50Ω and PDM logic is connected at both the sides of WPT system. The pulse densities d_1 and d_2 are set are 0.81 and 0.80 respectively. It gives the output voltage of 35.53V with the increase in efficiency of 80% at this operating point. Fig.(c) shows the u_1, u_2, i_1, i_2 of system when while Fig.(d) represents the waveforms of output current and output voltageof the matlab Simulink model.

Now R_L is increased to 125Ω and the pulse densities d_1 and d_2 are set at 0.68 and 0.65 respectively. It gives the output voltage of 38.19V with 82% of efficiency. Without PDM, the system efficiency as well as the output will reduced Fig.(e) shows the u_1, u_2, i_1, i_2 of system when R_L is 125Ω. Fig.(f) represents the waveforms of output current and output voltageof the matlab Simulink model.

At load resistance R_L equal to 25Ω,it gives very less voltage ripples in the output voltage while at R_L at 125Ω it shows very high ripples in an output voltage. At load resistance R_L equal to 50Ω it shows most uniform pulses of u_1, u_2, i_1, i_2 of system. By using pulse density modulation, we get highest efficiency as compared to all the existing MEPT implementations. Also it gives uniform waveforms with less phase difference.

TABLE I
SIMULATION CIRCUIT PARAMETERS

Parameter	Value	Unit
L_1	75.3	H
C_1	400	F
R_1	0.2	Ω
L_2	75.3	μH
C_2	400	pF
R_2	0.2	Ω
f_s	0.920	MHZ
C_f	2	pF
Vin	40	V

In the simulation circuit, by using a filter capacitor of value 2μF, we can get the output voltage ripplemagnitude valuelower than 1% [1], because of the method of pulse density modulationwith high switching frequency.

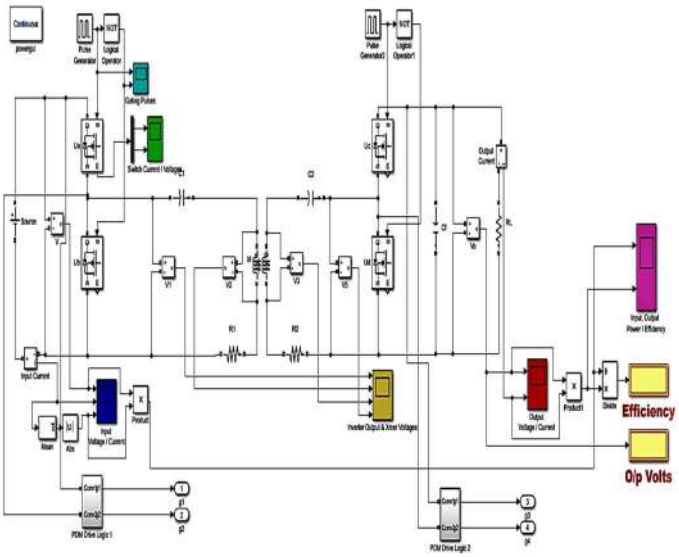
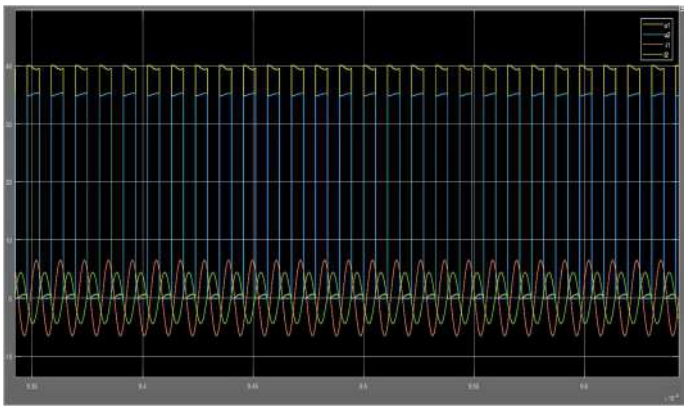
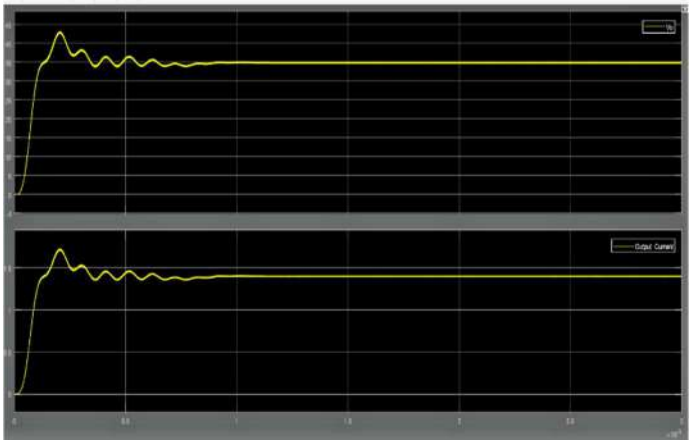


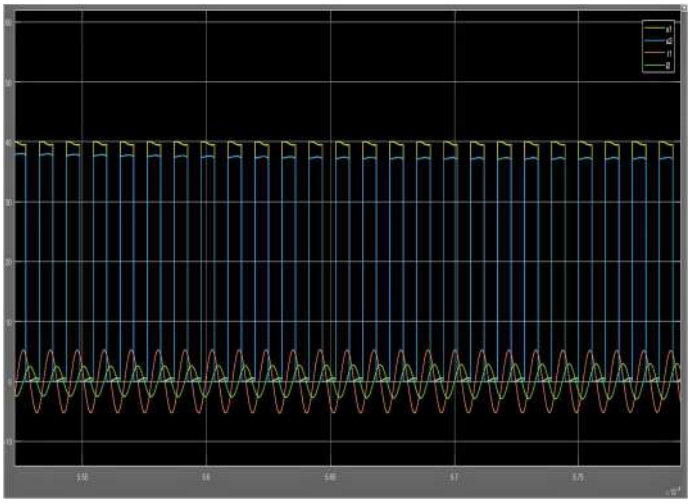
Fig.10: Matlab Simulation circuit of WPT with PDM for MEPT



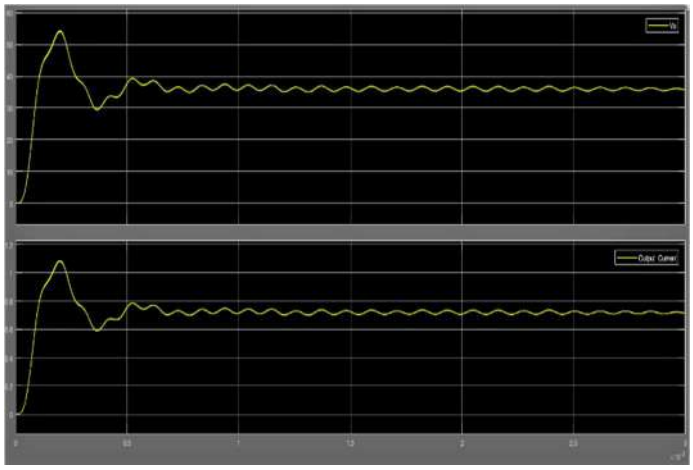
(a) R_L=25Ω, d_1=0.56, d_2=0.53



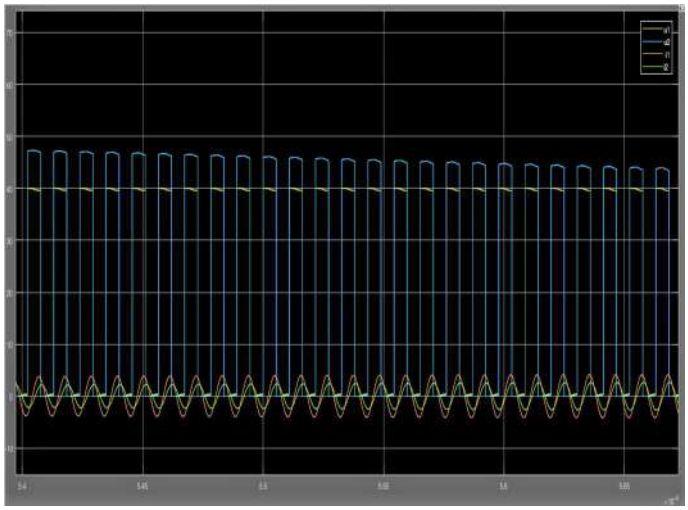
(b) Output Voltage and Current for R_L=25Ω



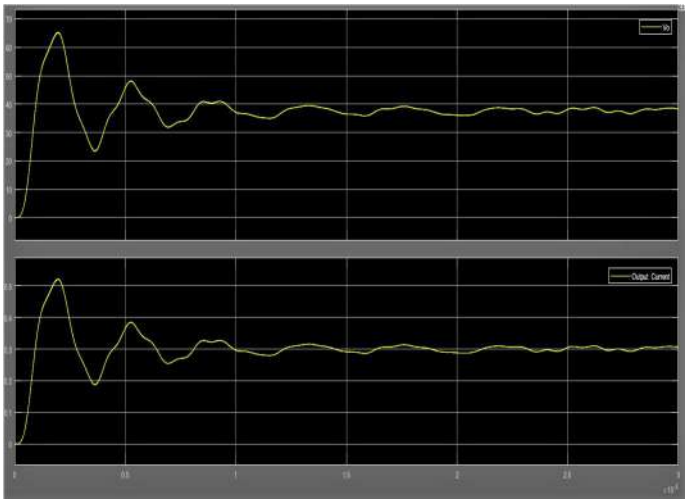
(c) R_L=50Ω, d_1=0.81, d_2=0.80



(d) Output voltage and current for R_L=50Ω



(e) R_L=125Ω, d_1=0.68,d_2=0.65



(e) output voltage and current for R_L=125Ω

Fig.11: Simulation results Waveforms

TABLE II

Simulation Circuit parameters with results

Input voltage (V_{in})	d_1	d_2	Load Resistance (R_L)	Output voltage (Vo)	Efficiency
40V	0.56	0.53	25	34.75V	83%
40V	0.81	0.80	50	35.53V	80%
40V	0.68	0.65	125	38.19V	82%

TABLE III

DETAILED MEPT REPERESENTATIONS RESULTS (SEQUENTIAL)

NO.	Frequency (MHZ)	Efficiency (%)	References
1	0.09756	69	[7]
2	6.78	72	[8]
3	0.035	46	[5]
4	0.515	74	[2]
5	0.917	72	[1]
6	0.92	83	This paper

Comparison with existing MEPT implementations:

TABLE III compares the MEPT implementations from past few years. Main parameters of these implementations are presented in the above table. An efficiency noted in all these implementations is the efficiency from source to load. All implementations operated at different frequencies. Out of all the existing implementations, this implementation gives maximum efficiency. This proposed method has some advantages over existing PDM implementations that it achieves higher efficiency, it provides goof voltage regulation and it operates at high frequency than the existing one.

CONCLUSION

MEPT implementation using PDM is presented in this paper with the highest efficiency in comparison with all the existing implementations.In comparison with all the existing implementations, this is the most compact implementation. Also, it eliminates all the drawbacks of existing implementations. It prevents the use of dc/dc converters in system (in comparison with traditional MEPT implementations), it minimizes the output voltage ripples (in comparison with on-off control), providessoft switching on transmitting and receiving sides both (in comparison with phase-shift control). A matlab Simulink model is designed in order to implement this proposed method of MEPT. By varying the load resistance and pulse densities we observed respective results for u_1, u_2, i_1, i_2 and output voltages and currents. At the low load resistance value, it gives maximum efficiency with the very low output voltage ripples. Also at high load resistance the output voltage is with the higher voltage ripples with low efficiency.So by using PDM for MEPT, WPT systems have good voltage regulation with higher efficiency upto 83% efficiency. Out of all the existing implementations, it gives maximum efficiency. This scheme has the downside that it is not suitable for systems having low value of frequency.

REFERENCES

[1] H.Li,S.Chen,J.Fang, Y.Tang,K.Wang, "Pulse density modulation for maximum efficiency point tracking of wireless power transfer systems,"IEEETrans. Power Electron., vol. 33, pp. 5492- 5501,2018.

[2] H.Li,Y.Tang,J.Fang, "Delta-sigmamodulationformaximum efficiencypointtrackingofwirelesspowertransfersystems,"*3rd International Future Energy Electronics Conference of IEEE,* pp.-434-43, 2017.

[3] H. Li, K. Wang,X. Yang, W. Chen, J. Fang "A Maximum Efficiency Point Tracking Control Scheme for Wireless Power Transfer Systems Using Magnetic Resonant Coupling," IEEE Trans. of Power Electron. vol.-30, pp.- 3998-4008, 2015.

[4] Y.Narusue,T.Asami, Y.Kawahara,"MaximumEfficiencyPoint TrackingbyInputControlforaWirelessPowerTransferSystemwitha SwitchingVoltageRegulator,"IEEE conference on WirelessPowerTransfer (WPTC), 2015.

[5] T. D. Yeo, J. W. Yu, S. T. Khang, D. Kwon, "Design of Maximum Efficiency Tracking Control Scheme for Closed-Loop Wireless Power Charging System Employing Series Resonant Tank," IEEE Trans. Of Power Electron., vol. 32, pp. 471-478, 2017.

[6] L. Q. Yuan, F. B. He, Y. M. Zhang,B. Y. Li,Z. M. Zhao, K. N. Chen, "Maximum Efficiency Point Tracking of the Wireless Power Transfer System for the Battery Charging in Electric Vehicles," *18th International Conf. on Information Fusion*, 2015.

[7] W.X.Zhong,S.Y.R.Hui,"MaximumEnergyEfficiencyTracking forWirelessPowerTransferSystems,"*IEEETrans.onPower Electron.*vol.30,pp.4025-4034,2015.

[8] M. F. Fu,C. B. Ma,X. E. Zhu, H. Yin, "Analysis and Tracking of Optimal Load in Wireless Power Transfer Systems," IEEE Trans. of Power Electron. vol. 30, pp. 3952-3963, 2015.

[9] M. Fu, M. Liu, C. MaH. Yin, "Loading and Power Control for a High-Efficiency Class E PA-Driven Megahertz WPT System," IEEETrans. on Industrial Electron. vol. 63, pp. 6867-6876, 2016.

[10] T. Diekhans, R. W. De Doncker, "A Dual-Side Controlled Inductive Power Transfer System Optimized for Large Coupling Factor Variations and Partial Load," Power Electronics conference of IEEE Transactions, vol. 30, pp. 6320-6328, 2015.

[11] S.Y.R.Hui,W.Zhong,"MaximumEnergyEfficiencyOperationof Series-SeriesResonantWirelessPowerTransferSystemsUsingOn-Off KeyingModulation,"PowerElectronics conference of IEEE., pp.1, 2017.

[12] K.Hata,Y.Hori,T.Imura,"Dynamic wirelesspowertransfersystem forelectricvehiclestosimplifygroundfacilities-powercontroland efficiencymaximizationonthesecondaryside,"*Applied PowerElectron.Conf.andExposition of IEEE,*pp.1731- 1736, 2016

[13] G.Lovison,Y.Hori,T.Imura and M.Sato,"Secondary-side-only simultaneouspowerandefficiencycontrol fortwoconverters inwireless powertransfer system,"in IEEE-41stAnnualConference onIndustrialElectronics Society(IECON), pp. 004824-004829, 2015

[14] D. Patil, B. Fahimi,M. Sirico, Lei Gu, "Maximum efficiency tracking in wireless power transfer for battery charger: Phase Shift and Frequency Control", IEEE conference of Power Electron., pp. 5090-0737, 2016.

[15] S.Li,C.Mi,"WirelessPower Transfer for ElectricVehicle Applications,"EmergingandSelectedTopicsinPower Electronics IEEE Journal,vol.3, pp.4-17, 2015.

[16] M. Fu, C. Ma and H. Yin, "Megahertz Multiple-Receiver Wireless Power Transfer Systems with Power Flow Management and Maximum Efficiency Point Tracking," Microwave Theory and Techniques conference of IEEE, pp. 1-9, 2017.

[17] J. Fang, Y. Tang, L. Zhang, X. Yang, "An Optimal Digital Pulse-Width-Modulated Dither Technique to Enhance the Resolution of High-Frequency Power Converters," Power Electronics conference of IEEE, vol. 32, pp. 7222-7232, 2017.

[18] H. Y. Leung, D. M. Budgett, A. P. Hu,D. Mccormick, "Pulse density modulated control patterns for inductively powered implantable devices based on energy injection control," IET conference on Power Electronics, vol. 6, pp. 1051-1057, 2013.

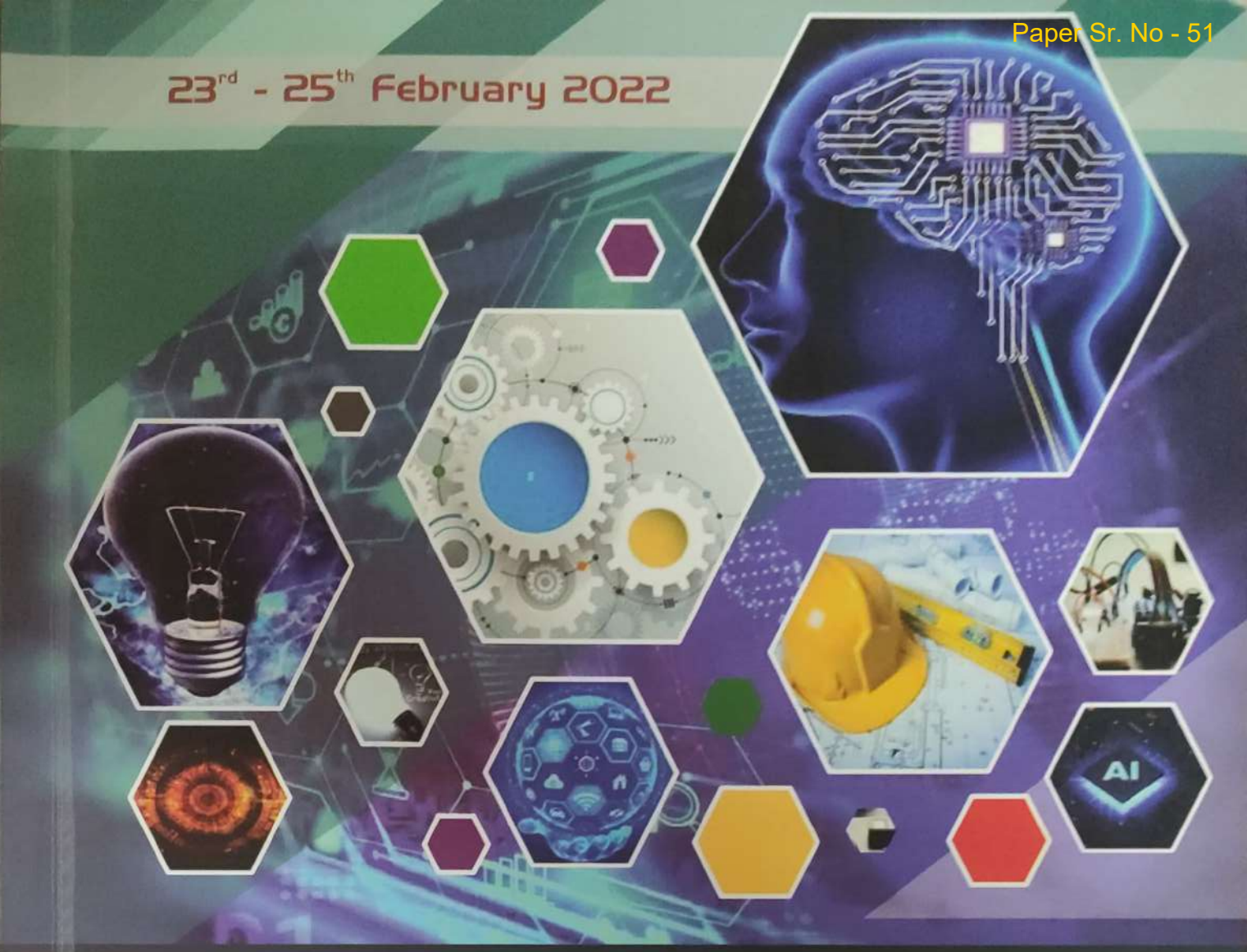
[19] H. Li, K. Wang, X. Yang,"Analysis and control of post regulation of wireless power transfer systems,"Southern Power Electronics Conference (SPEC) of 2nd AnnualIEEE conference,pp. 1-5, 2016.

[20] A. Kurs, R. Moffatt, P. Fisher, J. D. Joannopoulos,A. Karalis, M. Soljacic, "Wireless power transfer via strongly coupled magnetic resonances," Science conference, vol. 317, pp. 83-86, 2007.

[21] Daniel. T. Gladwin, R. Zhao, A. Stone, “Phase shift control based Maximum Efficiency Point Tracking in resonant wireless power system and its realization”, IEEE-42nd annual conference of industrial electron. Society (IECON) 2016

[22] I. J. Hwang, J. W. Yu, J. W. Kim, “Maximum Efficiency Point Tracking Scheme for Loosely Coupled Multiple-Receiver Wireless Power Charging System with Mutual Inductance Tracking”, microwave theory and techniques on IEEE conference, 2020

23rd - 25th February 2022



CONFERENCE PROCEEDING

FIRST INTERNATIONAL CONFERENCE ON

RECENT TRENDS IN ENGINEERING SCIENCE, TECHNOLOGY AND MANAGEMENT (IC - RTETM - 2022)

Sponsored By :

All India Council for Technical Education (AICTE)

Editors

Prof. Gayatri Jagtap Prof. Shrihari Upasani Dr. Permindur Singh

Organized By

Guru Gobind Singh Polytechnic Nashik

Accredited by National Board of Accreditation (2012-2015, 2017-2020, 2020-2023)

IC-RTETM 2022

(1st International Conference on Recent Trends in Engineering Science, Technology and Management)

All the papers published in this conference proceeding have been peer reviewed

ISBN: 978-93-93565-03-7

Disclaimer

Full length papers of IC-RTETM-2022 are accepted and printed in this Proceedings of IC-RTETM-2022 with the understanding that the same work has been neither submitted nor published elsewhere. Concurrent submission to other publications or journals is viewed as breech of ethics. The authors are responsible for obtaining copy-right and other clearance prior to submitting materials for consideration and acceptance. Views and Ideas expressed in the abstracts are solely from respective authors. Organizers are not responsible for authentication of the abstracts published in this book.

The authors are solely responsible for any legal matter resulting out of violation of copy-right act. This book is being published in the interest of authors and research community for private circulation only. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

Published by
Guru Gobind Singh Polytechnic Nashik
Khalsa Educational Complex, Guru Gobind Singh Marg, Wadala-Pathardi Road,
Indira Nagar Annexe, Nashik-422009

Printed and bound in India

Electricity Generation by Red Soil using Microbial Fuel Cell

Vivek Pawar
Guru Gobind Singh College of Engineering and Research Centre,
Nashik, India
vickypawar539@gmail.com

Rahul Patel
Guru Gobind Singh College of Engineering and Research Centre,
Nashik,
IndiaPatelr9864@gmail.com

Kartik Mavani
Guru Gobind Singh College of Engineering and Research Centre,
Nashik, India
Kartikmavani3113@gmail.com

Rehan Patel
Guru Gobind Singh College of Engineering and Research Centre,
Nashik, India
rehan.patel@gmail.com

Pallavi Padalkar
Guru Gobind Singh College of Engineering and Research Centre,
Nashik, India
pallavi.padalkar@ggsf.edu.in

***Abstract*— Red soil microbial community primarily consists of bacterial species that can generate electricity if a microbial fuel cell is incorporated with it. Since such electron producing bacteria are abundant in nature, microbial fuel cells can be considered as clean source of electricity generation and a prospect for renewable energy growth. Here, we have shown experiments with a real microbial fuel cell, investigating electrical power production from it using the red soil. A two-week study revealed also various nutrients were added to the soil, like kitchen wastes and Gunny bag pieces. At the smallest level, it can help remote rural areas to power lamps or other less energy intensive devices. Using a setup that includes anode, cathode and related electrical fittings this work has utilized these bacteria over time and observe the power they produce. The setup brings together the concept of energy, electronics and microbiology under one framework and is in line with issues relating to climate change, energy security and sustainability. An attempt has been made to explore the spectrum of scenarios and speculating the possibility of generating renewable power using the red soil. In the present study use of agar powder is made as proton exchange membrane. Cathode rods will be made up of graphite leads and copper/zinc strips to check the suitability of the power generation. The current so generated will be measured using a micrometer.**

***Keywords*— microbial, fuel cell, Cathode rods**

Effect of Positions & Orientations of Shear wall in Structure

Dhananjay Desale
Guru Gobind Singh College of Engineering and Research Centre,
Nashik, India
dhananjay.desale@ggsf.edu.in

Chetan Kankariya
Guru Gobind Singh College of Engineering and Research Centre,
Nashik,
chetan.kankariya@ggsf.edu.in

Vishvanath Kanthe
Guru Gobind Singh College of Engineering and Research Centre,
Nashik, India
vishvanath.kanthe@ggsf.edu.in

***Abstract*— Shear wall systems are one of the most feasible and hence commonly used to resist lateral load resisting mechanisms used in high-rise buildings. The position & orientation of these walls will change the stiffness of each floor in the structure, the diaphragm, centre of mass, displacement, and the drift of the floor. Stiffness and strength can be utilized simultaneously to resist large horizontal loads and to support gravity loads. The incorporation of shear walls has now become inevitable in multi-story buildings so as to resist the lateral forces. Hence it is very necessary to determine the most effective location of shear walls. Structural engineers preferred to distribute the walls in buildings to make the centre of mass almost close enough to the centre of rigidity but to make this condition satisfied, they have many choices such as constructing the walls on the perimeter, or using intermediate walls, sidewall, corner wall, etc. In this research effectiveness of the shear wall has been studied with the help of four different models. Model one is RCC frame structural system and the other four models are the shear wall orientation & positions structural system. An analysis is carried out by using ETAB. The comparison of these models for different parameters like Displacement, Storey Drift, and Story Shear has been presented by adding a shear wall with the column.Shear walls possess adequate lateral stiffness to reduce inter-story distortions due to earthquake-induced motions. In this study, analysis of shear walls with a moment-resisting frame using the Khan and S Barounis method is discussed. When two or more shear walls are connected by a system of beams or slabs total stiffness exceeds the summation of individual stiffness. Openings normally occur in vertical rows throughout the height of the wall and the connection between wall cross-sections is provided by connecting beams. Such shear walls are called coupled shear walls. The analysis of coupled shear walls by Rosman's continuous medium method is also discussed.**

***Keywords*— Shear wall, Orientation & position, Story drift, Displacement, Base shear, Etabs**

Smart Parking Underground Parking Station for Traffic Congested Localities in Metro Cities

Dadasaheb Bhavar
Guru Gobind Singh College of Engineering and Research Centre
Nashik, India
dadasaheb201175@gmail.com

Pallavi Padalkar
Guru Gobind Singh College of Engineering and Research Centre
Nashik, India
pallavi.padalkar@ggsf.edu.in

Tejashri Kulkarni
Guru Gobind Singh College of Engineering and Research Centre
Nashik, India
tejashri.kulkarni@ggsf.edu.in

***Abstract*— Every Metro city in our country is facing severe difficulty of adequate parking space. This is due to the number of vehicle ownership with the increased leaving standard has increased. As a result these vehicles are found parked on the streets, narrowing them for regular traffic. These narrowed streets won't serve the purpose in the disaster situation which will delay the rescue. The present study focusses on Nashik city marching towards being a Metro City for the study. In consideration we have focused on the localities like Ganjamal and Old CIDCO. The traffic and parking scenario of these two localities during the peak hours and during night hours. To conclude with the study we have identified two Municipal open spaces, which will serve their purpose on the surface and be utilized for the underground smart parking stations with their detailed design. The detailed design with the suggestions for implementation of Pay & Park to the municipal authorities.**

Keywords*— *Metro City, Traffic Congestion, Disaster, Smart Parking

Georeferencing and Digitization of Nashik city

Tusharkranti Pawar
GGSCOE, Nashik,India
tusharpawartp0511@gmail.com

Krishna Chauhan
GGSCOE, Nashik,India
krishnachauhan2134@gmail.com

Vaibhav Jadhav
GGSCOE, Nashik,India
jadhavvaibhav178@gmail.com

Ashwini Chavhan
GGSCOE, Nashik,India
ashwinichavhan0508@gmail.com

Rohit Bharambe
GGSCOE, Nashik,India
bharamberohit123@gmail.com

***Abstract*— Understanding of topography of a area is very essential for planning of any project in today's context. By converting hardcopy of Toposheet to GIS layers for better analysis, reference, etc by scanning the Toposheets. Many times, the boundary of a area with other detail cannot be capture in one toposheet. BY using the GIS we can create a single layer of a area which is in many part of toposheet by using Georeferencing and Digitization tool and create a toposheet which contain Waterbodies, Historical monuments, etc which can be used as reference for further development in the area like Road network, New irrigation plan, etc.**

Keywords*— *Base map, Edge match, GPS co-ordinate, Edge matching, Urban planning

Production of Ethanol by using Biodegradable Waste

Snehal Patait
Guru Gobind
Singh College of Engineering &
Research Centre
Nashik, India
snehapatait@gmail.com

Pallavi Patalkar
Guru Gobind
Singh College of Engineering &
Research Centre
Nashik, India
pallavi.patalkar@ggsf.edu.in

Aaditi Belekar
Guru Gobind
Singh College of Engineering &
Research Centre
Nashik, India
aaditibelekar@gmail.com

Anushka Pansare
Guru Gobind
Singh College of Engineering &
Research Centre
Nashik, India
anshkapansare07@gmail.com

Tejashree Khokrale
Guru Gobind
Singh College of Engineering &
Research Centre
Nashik, India
tejashrikhokrale@gmail.com

Abstract— India is an agriculture oriented country. Fruit production and generation of waste due to it has scaled to a large amount. Fruit wastes from food processing plants (such as natural juices, jams, jellies, etc.) are generated in large amounts, these wastes present a tremendous amount of pollution in developing countries. Fruit wastes have high levels of sugar, including sucrose, glucose, and fructose, that can be transformed to bioethanol through four process of pre-treatment, enzymatic hydrolysis, fermentation and distillation. The present study focuses on the production of ethanol as a solution to prevent pollution and to provide an alternative for the non renewable fuels. Jaggery is one of the major components used during the production of ethanol. The total results revealed the vegetables and fruits waste could be utilized for the production of bioethanol from recycled agricultural waste and management processes. The discussions showed that bioethanol optimum yield is produced at pH 4, the temperature 0.37°C and using 3 g/L yeast.

Keywords— non renewable e, Jaggery, biodegradable

Industrial Automation using Android Mobile via Bluetooth

Utkarsh Neshikkar
GGSCOE,
Nashik, India
utkarshneshikkar@gmail.com

Rohan Bhamre
GGSCOE,
Nashik, India
bhamrerohan8@gmail.com

Vishwas Nikam
GGSCOE,
Nashik, India
vishwasm1@gmail.com

Lavanya Chaudhari
GGSCOE,
Nashik, India
chaudharilavanya1402@gmail.com

Abstract— In fast moving world, time is most important factor. You can turn on/off device in the industry by giving command through cell phone. It will save time as well as manpower required to control industrial devices by using by command on android mobile, we can control six devices. We can increase the number of devices. Most important factor about this project is that it is controlled using an application on android mobile. The person who has installed the application on his/her android mobile can only interfere in the controlling devices. Also, it removes the need of carrying a remote control to turn on/off the devices. This project has integration of Android mobile technology and embedded system. Android mobile user has to install an application on his/her mobile handset to control the devices. Then he/she can give command using the buttons on the application. For this you have to turn on the Bluetooth on mobile, so the main wireless controlling technique used in this project is Bluetooth technology. Bluetooth receiver will be connected to the project. This Bluetooth device is connected to the circuit which has a decoder. It sends out a code for respective command sent by user. Then the respective device connected to the circuit will be turned on or off depending on the command given. For example, turn on Fan, Turn off Fan, Turn on buzzer etc. Such that by giving commands from mobile you can control industrial work .. This is more advantages, when we have to turn on the machinery at the time when we had another urgent task to do and we cannot get up from our place. In this case we can turn on machinery giving simply command through mobile phone. There is no need to go to field.

Keywords— Android,Blutooth,Buzzer

Estimation of seasonal variation in Module Temperature Model Coefficient for HIT PV Technology Module

Name: Mrs. Krupali Devendra Kanekar[1]
Research Scholar, Electrical and Electronics Engineering Department, SOET, Sandip University, Nashik, Maharashtra, India,

Assistant Professor, Department of Electronics and Telecommunication Engineering, D.Y. Patil deemed to be university, Ramrao Adik Institute of Technology, Nerul, Navi Mumbai, Maharashtra, India, Krupali.kanekar@rait.ac.in

Name: Dr. Prakash G.Burade[2]
Head of the Department, Electrical, Sandip University, Nashik, Maharashtra, India,
prakash.burade@sandipuniversity.edu.in

Name: Dr. Rahul Agrawal[3]
Associate Professor, Electrical Engineering Department, GCOERC, Nashik, Maharashtra, India,
rahulagrawal.sun@gmail.com.

Name: Dr. Dhiraj Magare[4]
Associate Professor, Department of Electronics Engineering, D.Y. Patil deemed to be university, Ramrao Adik Institute of Technology, Nerul, Navi Mumbai, Maharashtra, India,
dhiraj.magare@rait.ac.in

Abstract:

PV installed capacity has been rapidly increasing recently, according to a research by the International Energy Agency (IEA). However, given to their reliance on weather and environmental conditions, deploying PV systems to generate power is a significant challenge and can considered environmental factors, particularly ambient temperature, wind speed and direction, humidity, solar intensity and spectral distribution of irradiation. The standard test condition (STC) for PV modules is never accurately met at outdoor environment. So it is necessary to improve the performance of Photovoltaic system in a real time environment by considering the seasonal effects. Understanding the influence of spectral fluctuation with regard to season necessitates knowing the value and trends of spectral parameters. This research is particularly essential in the context of the Indian subcontinent because of seasonal variations in spectrum-related parameters for high-efficiency solar photovoltaic technology. The efficiency and output power of hetero junction with intrinsic thin-layer technology (HIT) PV technology assessed for site match the efficiency and output power estimated using module temperature, according to the findings. For that Root Mean Square Error (RMSE) factor is considerable.

Keywords: Photovoltaic, Hetero junction with intrinsic thin-layer technology (HIT), Spectral variation, module temperature, Root Mean Square Error (RMSE), Standard test condition (STC).

I. Introduction:

Among available source of energy, solar source is growing powerfully with various advantages, considering a less installation time, simple

circuitry, a more operation life, and very less attention towards maintenance. The exact and accurate knowledge related to parameter values of the model is little bit critical for various practical applications. Generally, a PV module's outdoor performance is lower than that of STC, which does not exist in the field. As a result, it's necessary to understand the values of the parameters, as well as their changes, that influence PV module performance in real-world situations [1]. With respect to change in weather condition, performance of photovoltaic module is varied. Because of this, variation in environmental condition has to be considerable. Solar PV module temperature has a significant impact on photovoltaic cell efficiency, and it affects output power. As a result, decreases performance of solar system.

The climate of India may be divided into four seasons such as monsoon, post monsoon, winter and summer based on differences in climatic factors such as air temperature, rainfall, and air current. In comparison to many other nations, the whole Indian subcontinent has a significantly diverse climate with highly varied seasonal patterns. [2, 3]. This research is particularly relevant in the context of the Indian subcontinent because of the intense monsoon season, which has the biggest reported variation in the spectrum-related parameter of all the seasons. The highest shift in the spectrum is observed in the month of monsoon because of scattering and absorption processes in the presence of clouds and aerosols, some sun wavelengths are attenuated more than others. [4].

Hirata et al. [5, 6] looked at how seasonal solar spectrum fluctuations affected mc-Si, a-Si, and Cadmium sulphide (CdS) PV modules in Japan. In terms of UF variation, Gottschalg et al. [7, 8] exhibited comparable spectrum fluctuations on various thin film technology modules at a UK location. In [9], a technique was developed to integrate seasonal fluctuations in the incident spectrum at a UK site for single and multi-junction a-Si modules. Annual spectral effect and its uncertainty for various technologies have been evaluated and linked to APE and MMF at another location in Germany [10, 11The influence of seasonal fluctuation on spectral distribution on performance ratio was researched at the Japan site, taking into consideration APE and module temperature on a-Si technology [12-14]. Seasonal spectral effects on c-Si modules were also examined by Simon and Meyer [15] in the Sub-Saharan area, where the spectrum is substantially different from the AM1.5 spectrum. A spectral correction parameter was utilised in another work done in Spain [16] to investigate the spectral influence on mc-Si and a-Si PV modules.

The spectrum impacts on PV device rating were modelled by Nann and Emery [17]. The findings of outdoor experiments [18] were discovered between the winter and summer months. Chegaar and Mialhe [19] investigated how different technologies differ in terms of intensity and spectral dispersion. Parretta et al. [20] created a loss model to describe how solar radiation affects c-Si module outdoor performance. Krauter et al. [21] demonstrated an increase in data precision for the factors that cause PV yield problems. As previously stated, India experiences a substantial monsoon season, which has a considerable impact on incidence spectrum. The Jawaharlal Nehru National Solar Mission (JNNSM), one of the world's largest PV schemes, is presently being implemented in India [22].

The spectrum measuring work presented here was carried out at India's National Institute of Solar Energy (NISE). This location is in Gurgaon, India's northernmost city, close to New Delhi. A year may be divided into four seasons at this site: winter season, summer season, monsoon season, and the post-monsoon season, often known as the transit period. Winter begins in the first week of November and lasts until the end of February. Whereas summer begins in the month of March and lasts

until the end of June. The monsoon season lasts from July to September, while the post-monsoon season lasts from October to the beginning of November. This paper involves finding of module temperature coefficient which is important factor to analyze the effect of weather conditions on Photovoltaic module. The necessity for module temperature prediction is critical for the best forecast of output energy generation, as local environmental parameters like as in-plane irradiance (G_t), speed of wind (V_w), and ambient temperature (T_a) fluctuate over time. It also includes calculating expected module temperature using the predicted coefficient ($T_{predicted}$) and module temperature using the site's stated model coefficient (T_{given}). For hetero junction with intrinsic thin-layer technology (HIT) technology modules, the experimental module temperature was compared to the expected module temperature based on projected coefficients.

II. Methodology:

For estimating the efficiency and output power module temperature (T_m) is very important parameter. This is because it directly effects on the output performance of the PV module. Photovoltaic array, data recorder with PV analyzer and supporting software which is used for communication and analysis make up the HIT photovoltaic test setup [23].

Fig.1 Outdoor test set up of three different PV technology modules at NISE, Gurgaon, India [23]

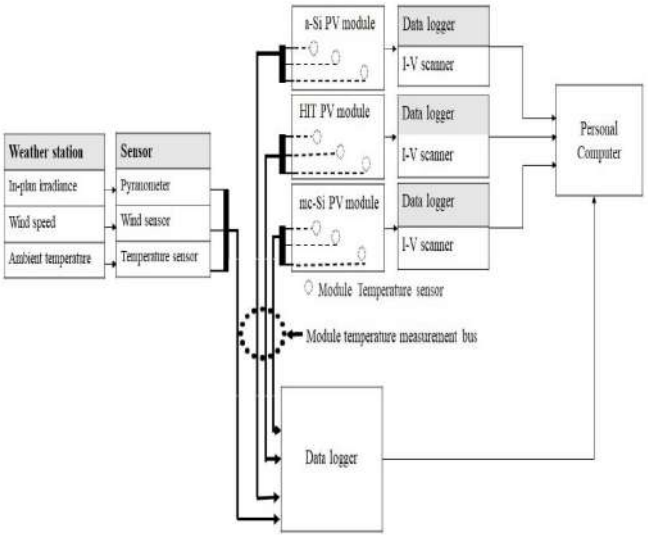


Fig. 2 Schematic experimental setup of PV module measurement system [23]

III. MEASUREMENT AND EXPERIMENTAL SETUP:

Figure 2 shows a schematic experimental measuring setup was used in NISE. In addition, this location is located at 28° 37'N latitude, 77° 04'E longitude, with a height of 216m above sea level. The identical area of these technologies' modules namely a-Si, HIT, as well as mc-Si is arranged at a slope angle of 28°, parallel to the sites. On the other hand, data loggers gather information from modules and send it to a computer for estimate, while environmental characteristics such as irradiance (G_t), speed of wind (V_w), and ambient temperature (T_a) are sensed by sensors and sent to data loggers, which then send the information to a personal computer. TABLE I shows a list of sensing devices and their resolutions that can be used in a weather base station. A pyranometer sensor was used to detect solar radiation. A propeller-style wind sensor that detects V_w at a height of around 3 meters. The temperature of the atmosphere is monitored using a K-type thermocouple. At a 10-minute period, real time data and each solar module temperature with current and voltage information were collected.

To record solar radiation on the exterior surface of the module with 305-2800 nm wavelength (λ) range, Pyranometer is used having resolution 10 W/ w^2. Wind sensor is used to record speed of wind V_w with standard resolution 0.3 m/s, 3°. In order to sense and record the atmospheric temperature, Temperature sensor with resolution 0.2°C is used [24].

For the implementation of this model for power deviation prediction, a heuristic modelling method was used. The model includes crucial environmental variables that impact the PV module's power both directly and indirectly. One of the environmental variables that have a significant impact on module power is irradiance. It has a straightforward impact on the module's current for short circuit (I_{sc}) and voltage for open circuit (V_{oc}), which are the two main components of output power. Because it contributes to the rise in module temperature, irradiance has an indirect influence on current and voltage. Other major environmental elements that impact module temperature are ambient temperature and speed of wind [24]. To estimate the percentage of the power departure from STC, a heuristic approach is presented in the following equation, which takes into account the inter-correlation and reliance of various environmental elements, as well as the manufacturer-specified technical parameters, on the power. This deviation from STC is given by (ΔP):

$$\Delta P = \left(\frac{P_{STC} - \left(\left\{ a_1 \cdot A \cdot G + a_2 \cdot A \cdot G \cdot \ln\left(\frac{G}{G_{STC}}\right) \right\} \left\{ 1 + \gamma_m \left(\left[a_3 \cdot \left(1 - \frac{P_{STC}}{G_{STC} \cdot A} \right) \cdot G + a_4 \cdot T_a + a_5 \cdot v_w + a_6 \right] - T_{STC} \right) \right\} \right)}{P_{STC}} \times 100, \right) \quad (1)$$

Where G_{STC}, P_{STC}, and T_{STC} are the irradiance, power, and module temperature at standard test condition, respectively. The in-plane irradiance, ambient temperature, and wind speed, respectively, are the instantaneous environmental parameters G, T_a, and V_w. The power generation components owing to the direct influence of irradiance are connected with coefficients a_1 and a_2, whereas the terms related to module temperature are associated with coefficients a_3, a_4, a_5 and constant a_6. The formulation of module temperature as a set of linear terms with varying coefficients obtained from empirically recorded module temperature using regression analysis, which takes into account the interdependency of some factors to a great extent. The terms with a_3 to a_5 coefficients and constants in Eq. (1) produce this linear expression of module temperature.

IV. Result and Discussion:

This section proposes utilizing the provided model to forecast the power departure from STC for HIT technology. The model's coefficients were derived using measured data over a one-year period, together with manufacturer-specified technical characteristics, using regression analysis. The observed module temperature was utilized in the regression analysis to get the model's coefficients a_3, a_4, a_5, and constant a_6. These coefficients were then employed in the regression analysis, together with the observed power deviation, to derive the model's a_1 and a_2 coefficients. Coefficients are obtained for various seasons namely monsoon, post monsoon, winter and summer and are given in the table I.

TABLE I: Model coefficients and constants for different seasons.

Sr. No	Coefficients	Monsoon	Post Monsoon	Winter	Summer
1	Power Coefficient, a1	-0.009569857	-0.251836114	-0.01129066	-0.009801334
2	Power Coefficient, a2	0.005516125	0.00209114	0.013256858	0.003972134
3	Irradiance, a3	0.025972401	0.037574206	0.036371289	0.031680398
4	Ambient temperature, a4	1.661091442	1.284943407	1.19596994	1.063676577
5	Wind Speed, a5	-1.432703961	-2.557889528	-1.60401896	-1.030342988
6	Intercept, a6	-12.81548652	-4.188362863	-1.97690904	-0.776726128

The site condition may affect the coefficients associated to module temperature (a_3–a_6). These coefficients are proportional to the temperature of the module. The coefficients a_1 and a_2, which

are connected to power generating terms, are mostly related to module technical characteristics. The a_1 coefficient would have a considerable influence on power, which would follow the seasonal efficiency trend for PV modules. Other coefficients, such as a_2, have a greater influence than the a1 coefficient. These coefficients were considered to forecast the deviation of average power with respect to standard test condition based on seasonal climatic data and the manufacturer-specified module parameter.

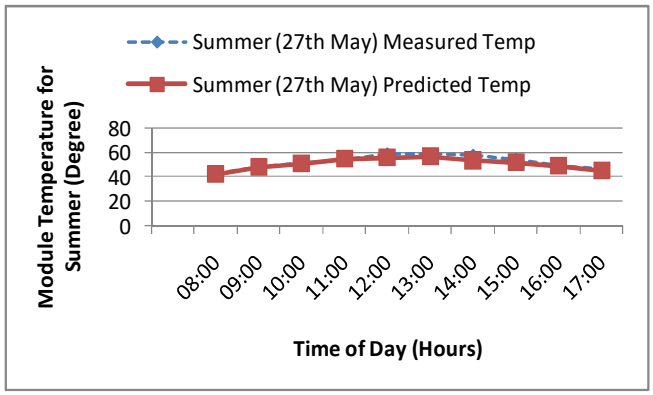


Fig. 3 Measured and predicted temperature for summer season

Figure 3 represents the measured and predicted temperature for summer season. To represent different weather conditions, from each season one day is selected, and readings were taken at 10-minute intervals. The time consider for the same is in between 8 AM to 5 PM. From the graph, it has been seen that observed and predicted temperature are following to each other. Figure 4 shows the variation in measured and predicted temperature. If we see season wise graph, it is observed that observed module temperature is matching with predicted one.

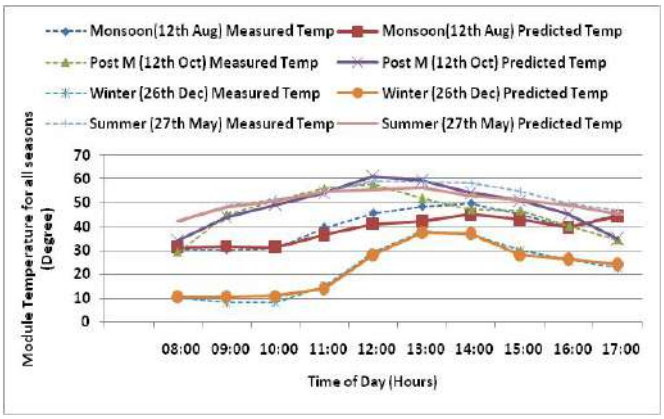


Fig. 4 Season wise Measured and predicted temperature

Figure 5 represents Comparison of measured and predicted P_{out} for summer season. Figure 6 compares the percentage power variations expected and empirically measured. The predicted total output power was found to be in close agreement with the measured total output power.

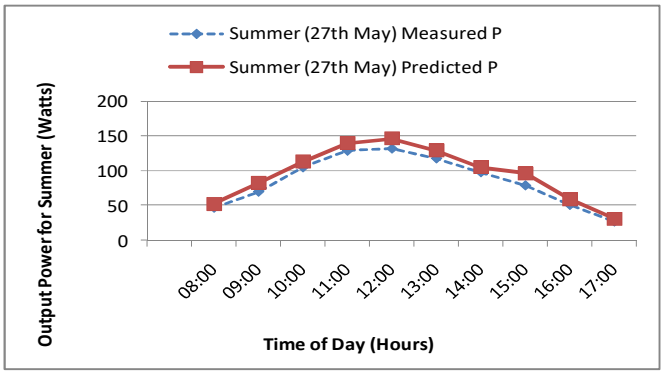


Fig. 5 Comparison of measured and predicted Pout for summer season

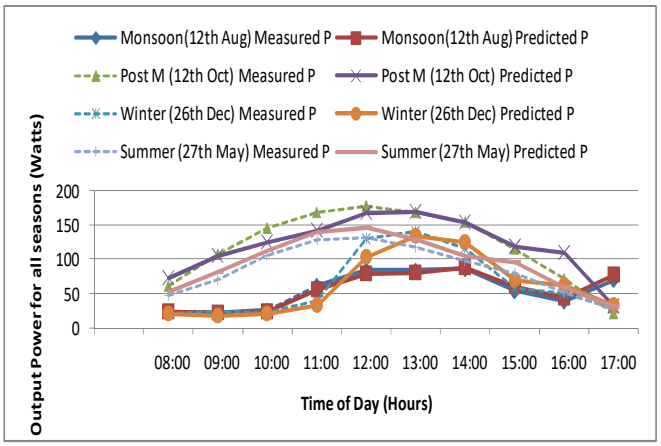


Fig. 6 Comparison of measured and predicted P_{out} for various seasons

TABLE II: RMSE for temperature and power for HIT Technology.

Season	RMSE For Temperature	RMSE For Power
Monsoon	4.908776	2.470357
Post monsoon	4.002069	2.760718
winter	3.51386	3.10062
summer	3.246174	2.429577

Because of strongly four seasons in India, the graphs plots for particular season are drawn for HIT technology. However, RMSE has been used to quantify the difference between experimental and predicted values and it is shown in table II.

From Graphs represented in figure 3 to 6, it is observed that, monsoon and post monsoon seasons will give more variation due to variation in environment and temperature. Because of this reason Root mean square value for monsoon and post monsoon seasons are more as compared to summer or winter. So from that can conclude that, HIT technology is more suitable for summer as it is showing lowest root mean square value among all the four seasons.

V. Conclusion:

The current paper presents the relative seasonal effects of Hetero junction with intrinsic thin-layer (HIT) technology module under Indian environment. During the estimating process, it was discovered through analysis that monsoon and post monsoon seasons are more sensitive to variation in seasonal spectral. It is also observed that, HIT technology is more suitable for summer as it is showing lowest root mean square value among all the four seasons.

Acknowledgment:

The authors would like to express their gratitude to Japan's Advanced Industrial Science and Technology (AIST).

REFERENCES

1. Gray, L.J., et al.: Solar influence on climate. Rev. Geophys. 48(4), 1–53 (2010)

2. Kelkar, RR: Monsoons elsewhere in the world, Monsoon Monograph. In: Tyagi, A., et al. (eds.) Government of India, Ministry of Earth Sciences, India Meteorological Department, vol. 1, pp. 96-119 (2012)

3. Prasanna, V.: Impact of monsoon rainfall on the total food grain yield over India. J. Earth Syst. Sci. 123(5), 1129–1145 (2014)

4. Parthasarathy, B., Munot, A.A., Kothawale, D.R.: All India monthly and seasonal rainfall series: 1871–1993. Theor. Appl. Climatol. 49, 217–224 (1995)

5. Hirata, Y., Tani, T.: Output variation of photovoltaic modules with environmental factors-I. The effect of spectral solar radiation on photovoltaic module output. Sol. Energy 55, 463–468 (1995)

6. Hirata, Y., et al.: Output variation of photovoltaic modules with environmental factors-II seasonal variation. Sol. Energy 63, 185–189 (1998)

7. Gottschalg, R., Betts, T.R., Infield, D.G., Keamey, M.J.: Experimental study of variations of the solar spectrum of relevance to thin film solar

cells. Sol. Energy Mater. Sol. Cell 79, 527–537 (2003)

8. Gottschalg, R, Infield, DG, Kearney, MJ: Influence of environmental conditions on outdoor performance of thin film devices. In: Proceedings of 17th European Photovoltaic Solar Energy Conference, pp. 796–799 (2001)

9. Gottschalg, R, Cueto, J D, Betts, TR, Williams, SR, Infield, DG: Investigating the seasonal performance of amorphous silicon single and multi-junction modules. In: Proceedings of 3rd World Conference, pp 2078–2081 (2003)

10. Dirnberger, D., Blackburn, G., Mu¨ller, B., Reise, C.: On the impact of solar spectral irradiance on the yield of different PV technologies. Sol. Energy Mater. Sol. Cells 132, 431–442 (2015)

11. Dirnberger, D., Mu¨ller, B., Reise, C.: On the uncertainty of energetic impact on the yield of different PV technologies due to varying spectral irradiance. Sol. Energy 111, 82–96 (2015)

12. Nakada, Y., Fukushige, S., Minemoto, T., Takakura, H.: Seasonal variation analysis of the outdoor performance of amorphous Si photovoltaic modules using the contour map. Sol. Energy Mater. Sol. Cells 93, 334–337 (2009)

13. Minemoto, T., Nagae, S., Takakura, H.: Impact of spectral irradiance distribution and temperature on the outdoor performance of amorphous Si photovoltaic modules. Sol. Energy Mater. Sol. Cells 91, 919–923 (2007)

14. Ishii, T., Otani, K., Itagaki, A., Utsunomiya, K.: A simplified methodology for estimating solar spectral influence on photovoltaic energy yield using average photon energy. Energy Sci. Eng. 1(1), 18–26 (2013)

15. Simon, M., Meyer, E.L.: The effects of spectral evaluation of c-Si modules. Prog. Photovoltaics Res. Appl. 19, 1–10 (2011)

16. Fabero, F, Chenlo, F: Variance in the solar spectrum with the position of the receiver surface during the day for PV applications. In: 22nd IEEE Photovoltaics Specialists Conference, pp. 812–817 (1991)

17. Nann, S., Emery, K.: Spectral effects on PV-device rating. Sol. Energy Mater. Sol. Cells 27, 189–216 (1992)

18. Ragot, P: Analysis of performance of amorphous silicon modules by experimentation in indoor and outdoor conditions. In: Proceedings of 10th European Photovoltaic Solar Energy Conference (1991)

19. Chegaar, M., Mialhe, P.: Effect of atmospheric parameters on the silicon solar cells performance. J. Electron Dev. 6, 173–176 (2008)

20. Parretta, A., Sarno, A., Vicari, L.R.M.: Effects of solar irradiation conditions on the outdoor performance of photovoltaic modules. Opt. Commun. 153, 153–163 (1998)

21. Krauter, S, Preiss, A, Ferretti, N, Grunow, P: PV yield prediction for thin film technologies and the effect of input parameters inaccuracies. In: Proceedings of 23rd European Photovoltaic Solar Energy Conference, pp. 740–743 (2008)

22. Jawaharlal Nehru National Solar Mission. Ministry of New and Renewable Energy Government of India, pp. 1–15 (2010). http:// www.mnre.gov.in/file-manager/UserFiles/mission_document_JNNSM.pdf. Accessed 20 June 2015.

23. Magare, D., Sastry, O. S., Gupta, R., Kumar, A., and Sinha, A., 2012,“Data Logging Strategy of Photovoltaic (PV) Module Test Beds,” 27th European Photovoltaic Solar Energy Conference (EU PVSEC), Frankfurt, Germany, Sept. 24-28, pp. 3259-3262.

24. Magare, D., Sastry, O., Gupta, R., Bora, B., Singh, Y., & Mohammed, H. (2017). “Wind Effect Modeling and Analysis for Estimation of Photovoltaic Module Temperature.” Journal of Solar Energy Engineering, 140(1), 011008. doi:10.1115/1.4038590

An Immersive Approach towards Sustainable Farming Using IoT: A Review

[1]Pratik Ghutke, [2]Rahul Agrawal
Department of Electrical Engineering, TGPCET, Nagpur
pcghutke2214@gmail.com
Department of Electrical Engineering, Guru Gobind Singh College of Engg. & Research Center, Nashik
rahulagrawal.sun@gmail.com

Abstract: Despite the fact that the agricultural process is now more data-driven, accurate, and intelligent than ever before, there is still a perception that farming is less efficient than it used to be. Smart agriculture has undergone a paradigm change from statistical to quantitative methodologies as a result of the rapid emergence of Internet-of-of-things (IoT) technology. Such large-scale developments are upending traditional farming methods while also presenting new possibilities in an already troubled industry. Wireless sensors and the Internet of Things (IoT) have the potential to revolutionise agriculture, but they also have the potential to cause problems when they are used in conjunction with traditional farming methods. Research on Internet of Things (IoT) devices and communication protocols has been conducted on wireless sensors used in agriculture applications. Soil preparation, crop condition and watering, bug and pest detection, and other agricultural purposes are included in the list of sensors. In this video, the benefits of using this technology are outlined, from seeding to harvesting, packing, and shipping. Additionally, this article discusses the usage of drones for crop surveillance and other beneficial purposes, such as crop production improvement. Whenever feasible, the most cutting-edge IoT-based designs and platforms in agriculture are featured. To sum up, we outline existing and future IoT trends in agriculture, and the research challenges that may arise from these developments.

Keywords: - Smart agriculture, cutting-edge agricultural practises, sensors, and the Internet of Things (IoTs).

I. INTRODUCTION

Farming is the foundation in India's economy. Since life is impossible without agriculture as business provides the primary source of nutrition for us. The farmer has to work himself every day of the week to produce the crop which makes him less income, so he has to try some other options for his food, as well as today there is less access to work to practice horticulture Therefore, mechanization is essential in the rural cycle. Accordingly, this work proposed a framework so that livestock farmers could productively carry out their horticultural practices from remote locations while providing fewer ideal opportunities for farmland. In this framework, all the equipment works alone with the help of sources of information from sensors that are continuously checking the rural land, and ranchers can screen whether everything is going well or some activity should have been done. The entire cycle is controlled and monitored by a programmable regulator. Solar primarily based power is the maximum considerable source of electricity inside the whole plants. Solar based electricity is not most effective a reaction to the contemporary electricity emergency, but additionally a sort of energy that is related to weather. The solar era is the era of efficient use of solar energy. Solar chargers (solar powers) are momently used to power street lights and water radiators. The unexpected drop in the price of solar chargers is increasing their use in various fields. This innovation is used in horticultural water supply systems. Inside the cutting-edge nation of energy emergency in India, a solar powered water system infrastructure can be an inexpensive option for farm animals' farmers. it's far a conductive to imparting green energy that releases strength when the underlying is estimated. Water device design is a dangerous water detection method for the vicinity or soil that bureaucracy the primary basis of our yield shape. Water for the most element should be made available within the fields or through pits. This framework will lessen the responsibility of the rancher and hold enough soil pleasant for better development. From that factor on, the development was viable in that it introduced a ranch water system into the field, which quickly killed units. This mechanical fin is the entire structure of an electric water system washed out of the field. In term of GSM, there are two important developments in the water supply system. "GSM" is an arbitrary and basic moderator or handler. When it comes to mobile data collection, the Global System for Mobile Communications (GSM) is the standard. Nowadays the agriculturist is focused on increasing output while keeping expenses down. This strategy necessitates an innovative approach to handle the problem and boost output and profitability while minimizing food production's environmental impact. Precision agriculture in the cultivation field necessitates several ecological criteria that indirectly analyse the aforementioned issue. However, because the intra-field variability in sugar beet production and quality is unknown, it must be assessed in terms of soil qualities and microclimate conditions. The crop environment's observed variability can therefore be managed by tailoring inputs to the places where they are needed. As a result, the precision agriculture model has been used and advanced in this study to track crop growth while taking into consideration field changes air temperature, soil moisture, soil type and other factors. Precision agriculture improves agricultural earnings and resource usage by reducing the use of traditional management practices. Precision farming has an impact on yield-based crop development depending on the soil type. Precision agriculture techniques have the potential to improve the Indian agricultural economy. The suggested research

focuses on identifying limiting factors that have an impact on crop output. Providing precise water-based soil conditions predictions. Proposals for various irrigation plans based on socio-economic factors.

1.1 Irrigation System in India

In India, rural areas hold 18% of the US debt (GDP) and attract 49% of the workforce. According to records, 2022 of the military will be deployed in agricultural areas. 0205,000 siphons are continuously delivered to rural areas. Production of waste water devices, including siphon sets, uncontrolled water intake, unplanned water supply systems, water and energy savings, water loss and lack of experience.

Table 1. Crop productivity (MT/Ha)

PLANT	INDIA	WORLD	HIGHEST
Cotton	4.69	7.36	11.4 (China)
Maize	1.9	4.6	14.6 (Israel)
Oilseeds	0.87	1.87	4.09 (Germany)
Onions	10.7	17.8	46.8 (USA)
Paddy	2.97	3.9	8.9 (Egypt)
Potato	19.6	15.9	48.6 (Belgium)
Pulses	0.59	0.9	4.6 (Netherland)
Soya	0.95	2.34	3.58 (Turkey)
Sugarcane	69	63	1.17 (Zimbabwe)
Tomato	16.5	26.8	61.9 (USA)
Wheat	2.76	2.88	7.9 (Germany)

Table 1. shows the effectiveness of different yields in India and the world. Unlike the general use of the world, India has a low yield potential. This is due to a decrease in the use of water in the water system as a result of the development of various misfortunes,

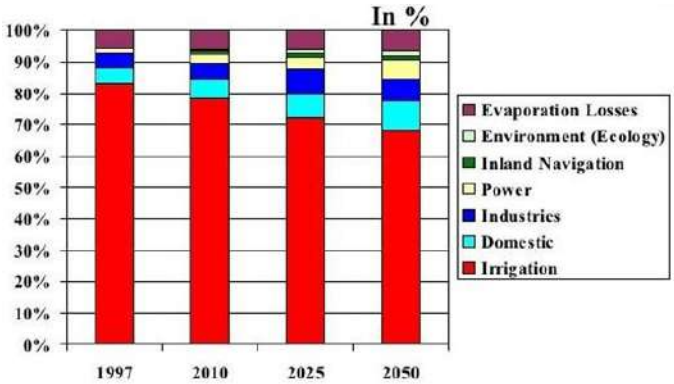


Figure. 1 Availability of water for Irrigation

As shown in Figure 1. The repetition of dry season is increasing steadily, adversely affecting the usefulness of the crop. The dry season after that may be a repetition of the dry season, it is no shaggy dog story. The recurrence of drought in exceptional regions of India is proven in determine three. Streamlining water system productivity and electricity use is a vital take a look at inside the current water device state of affairs. Controlling using water sources is extremely fundamental to reap maximum core yield in higher energy use. Maintaining water device efficiency is extremely challenging. The effectiveness of a water device is the ratio of water utilized by the dust to the filth that is distributed through the water system. The effectiveness of the water device has to be cohesive, i.e., the water utilized by the filth and the contribution of water to the effluent via the water device ought to be same. If the performance of the water system is more prominent than the consent, the structure of the water device cannot satisfy the dirty water hobby. If the efficiency of the water unit is not as high as the clutch, this redundancy is supplied by using the water machine structure, which induces wastage of water.

Table 2. Water losses in Percentage in India

Sources of Losses	Leakages	Evaporation	Total
Canals & Branch Canals	13.6	3.4	17.0
Branches	6.4	1.6	8.0
Courses on the Field of Water	16.0	4.0	20.0
Field application Losses	13.2	3.3	16.5
Total	49.2	12.3	61.5

The water system's structure is prone to large amounts of water catastrophe, reducing the effectiveness of the water system. What's more, the water system productivity of the different structures is analyzed, given in Table 2.

Figure 3. Frequency of occurrence of drought in various parts of Country

Here in Figure 3, Experts are baffled by the frequency of droughts shown in official data. According to the agriculture ministry's drought management section, Assam would experience a drought-like condition once every 15 years. However, the trend shows that the state has had three droughts in the last nine years (including this year). Though Bihar and Uttar Pradesh are only vulnerable once every five years, the state has seen three drought-like circumstances in the last five years, while Uttar Pradesh has experienced two. The statistics

for the southern states, particularly Karnataka and Andhra Pradesh, are considerably more mixed. While the states have had numerous droughts in the last five years, a study suggests that Karnataka is vulnerable once every five years and Andhra Pradesh twice every five years.

1.2 Factors Responsible for Low Productivity:

Existence of Big Farmers: Even though India's Zamindari system has been abolished, rural large farmers continue to play a shadow role. These large landowners control rent, tenure, tenancy rights, and other aspects of renters' lives. As a result, the situation of tenants is deteriorating day by day. It is quite difficult to increase productivity using solely modern technologies in this type of tenure structure.

High Land-Man Ratio: Huge demographic pressures characterize Indian agriculture. According to the 2001 Census, over 72.2 percent of the entire population lived in rural areas, with agriculture employing nearly three-quarters of the total rural working population, or nearly 228 million employees (out of 310.7 million workers). Uneconomic land subdivisions occur as a result of population growth. All of these factors contribute to low production.

Rural Environment: In India, the rural social milieu is a major contributor to low productivity. Farmers in India are lethargic, illiterate, superstitious, have a primitive outlook, are conservative, unfit, and resistive to modern farming methods. Farmers' marginal productivity in agriculture is zero, due to the family-based farming method. Credit and marketing facilities that are irregular and insufficient: According to Raj Krishna's research, poor farmers are unable to effectively spend money in the land during the peak season of agriculture due to a lack of and insufficient availability of agricultural loans at a low rate of interest. Furthermore, crop marketing is regulated by intermediaries or touts. As a result of all of this, agricultural productivity was low. Modern technologies are lacking: In India, over 60% of cultivable land lacks irrigation facilities. In 2000-2001, only 75.14 million hectares (out of 87.94 million hectares) were irrigated. As a result, the green revolution's 'Package Program' is ineffectual across the vast majority of India's gross cultivated areas. Degradation of the Ecosystem: According to the Indian government, 329 million hectares (almost half of the country's land) have already been degraded. This leads to a yield loss of 33 to 67 percent. Furthermore, 5% of the land has been ruined to the point where it can no longer be utilized.

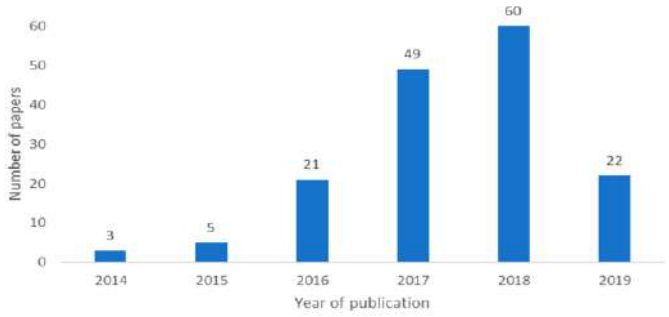


Figure 4. Annual number of articles presenting IoT irrigation systems that have been published.

Figure 4 shows that interest in this issue has grown over time as measured by the number of papers published every year.

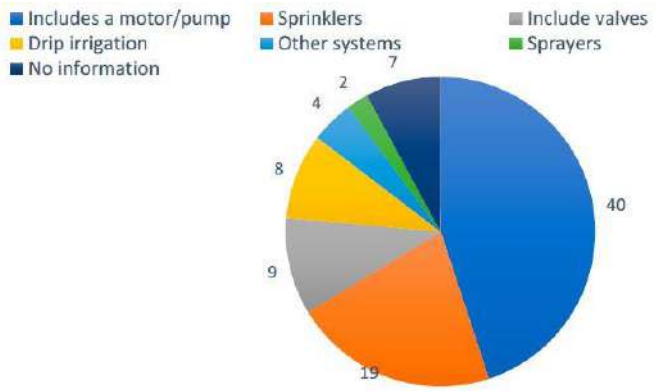


Figure 5. Number of papers that propose different irrigation systems

1.3 Water Management:

There are various ways to distribute water irrigated agriculture is a type of agriculture that uses water as a source of input. The effectiveness of the various possibilities varies, in some circumstances, a specific technique for a given crop should be adopted. Irrigation can be done in a variety of ways, but they can all be categorised into the following groups: There are four methods of distributing water: flood irrigation, spray irrigation, dripping, and nebulizer. Unplanned irrigation (i.e., irrigation that occurs without prior planning) can be contrasted with planned irrigation (i.e., irrigation that is carried out in accordance with estimates of annual demand); and (iii) adhoc irrigation, in which the amount of water is estimated based on sensor readings. In this part, 83 of the 89 reviewed articles include detailed information about the planned irrigation system, while the remaining six just state that irrigation actuators are present (see Figure 5). There are 49 articles that just indicate that their system has motors/pumps (40 papers) or valves (nine papers) without providing any additional information. 19 of the studies that provide additional information use sprinklers. Three papers [41,43,51] suggest using a fogging system in conjunction with the main irrigation system, whereas two papers [42,52] suggest using fertigation in their systems.

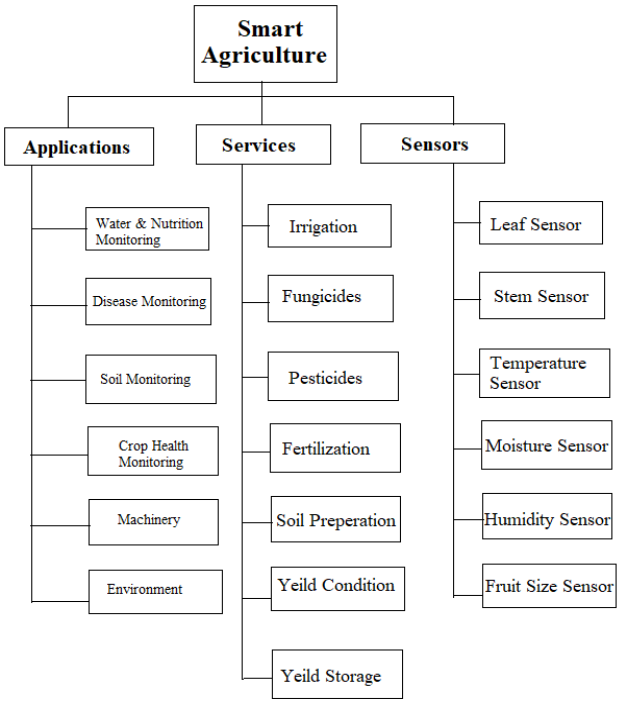


Figure 6. Applications, services and sensors are all part of the "smart farm" stack.

1.4 Major Applications

The Internet of Things (IoT) can help with many traditional farming challenges, such as drought response, yield optimization, land appropriateness, irrigation, and insect management, by utilising smart agriculture methodologies. Fig. 6 displays a smart agricultural application hierarchy of important apps, services, and wireless sensors. While key examples of how modern technology might aid in improving overall efficiency at various levels have previously been covered.

Figure 7. Challenges in technology implementation for smart agriculture system.

When you think of the word, two words come to mind: [12] and [16]. Current applications appear to be simply scraping the surface of IoT's potential, with the full extent of its influence and applications still to be seen. Given the recent increase, we may expect. Figure 8 displays the important technology drivers in smart agriculture, whereas figure 7 depicts the major technological implementation roadblocks.

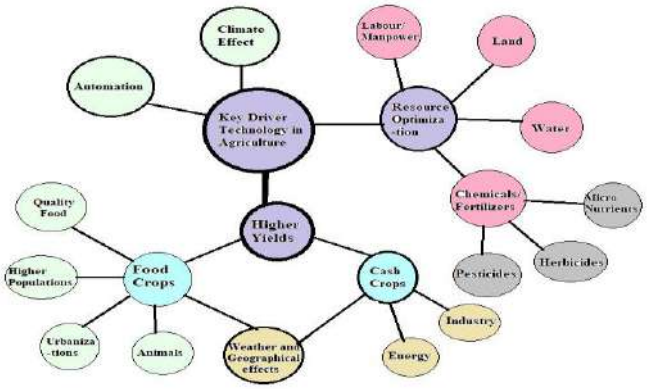


Figure 8. The agricultural industry's key technological drivers.

Solar PV System Design

The PV system generates electricity throughout the year, despite the fact that irrigation water demand is often seasonal. It is essential that the solar PV system be able to supply the electricity needed by the irrigation system to ensure that the volume flow rate of water required by all crops is uniformly distributed. The proper design of a PV system relies on accurate information about solar resources. As part of this inquiry, the Chilean Ministry of Energy's online tool, the Solar Explorer, was used. A solar PV model from Solar Explorer is employed in this research. According to the reference, it is based on a model developed by Sandia National Laboratories. The Solar Explorer was also used to collect radiation data for each unique location, which was subsequently put into the PV model for solar power generation. The accuracy of the radiation database is discussed in great detail in the source. Technology and Applications of the Internet of Things Here, the author discusses how important IoT and RFID are. If IOT is properly managed and reliably transmitted, it can connect any and all devices at any time, from any location. You can find a variety of strata.

1. Sensing data is sent to the network at this level, which serves as the first point of access for that data.

2. A network's knowledge resources can be pooled at the second layer of the network.

3. Real-time data processing requires a third layer of middleware.

4. To merge the bottom system's functions at the application layer. RFID technology is employed in this project to identify different types of enemy aircraft. Inventory management, transportation, high security, and high irresponsibility are all possible applications for RFID devices. Antenna technology is a critical component of RFID..

Design Patterns for Agriculture's IoT Irrigation Systems

To give an overview of the most popular architectures for these systems, this paragraph will discuss the following. In

IoT irrigation management solutions, multi-agent architectures are widespread [60,61]. These structures provide a distinction between the numerous components that make up its structure. The difference is typically made depending on the architectural strata in which We have a place for everything. Nodes at the top of the hierarchy, for example, may serve as brokers for nodes at the bottom. [60] A lot of designs are broken down into layers or functional blocks that represent the most important things that need to be accomplished [62]. Many IoT irrigation management system architectural designs use these generic blocks or layers. Devices, connectivity, services, administration, applications, and security are all critical components of these designs. The Internet of Things (IoT) is a network of interconnected devices that can detect, monitor, control, and take action. The devices' interfaces must allow them to communicate with other devices in order to convey the important data. Different actuators will be able to use the information obtained by numerous sensors together. In order to move data between devices, it must first be captured. In order to complete this operation, communication protocols must be used. To make an IoT system work with other IoT systems, a variety of communication protocols are typically employed. Device discovery, device control, and data analysis may necessitate the use of third-party services. Programs allow the user to communicate with the system. Data gathered through monitoring and data retrieved after processing by the applications will be visible to the user. At various points in time, it is possible to perform actions that are related to the data and that can also be performed automatically by the user.

Consider the system's security as a final consideration. Perception, network, and application have traditionally been regarded as the three layers of IoT architecture. A layer that sits in the middle of the network and the applications was created after much research. There are two types of service layers in cloud or fog computing environments: those that store data and those that do computations. A new architecture based on four layers, objects, edge, communication, and cloud, has been proposed in recent years by authors like Ferrández-Pastor [63]. Edge-layer apps are used to locate and regulate key ones in the authors' present architectural proposals. Furthermore, cloud services, data storage, HMI interfaces, and analytic applications can all be found in the cloud (internet/intranet). Figure 29 shows an example of the architecture models. Sensors 2020, 20 x 34 of 48, includes devices with these applications and security are included in the design process. The Internet of Things (IoT) is a network of interconnected devices that can detect, monitor, control, and take action. All of the devices need to communicate with each other via interfaces to send the most important data. The data gathered by a variety of sensors will be analysed in general and applied to a variety of actuators. Data and actions observed by the devices must then be transmitted between them. Protocols are necessary for this task. To make an IoT system work with other IoT systems, a variety of communication protocols are typically employed. Device discovery, device control, and data analysis may necessitate the use of third-party services. The programmes allow the user to communicate directly with the system via the system. The user will be able to see information gleaned from data after it has been processed by the applications, as well as information gleaned from monitoring data. The user can take actions that are crucial to the situation given by the data, and these actions can also be conducted automatically on a number of occasions. Make sure the system's security is checked out before moving forward. Perception, network, and application make up the classic three-tiered structure of the Internet of Things. Numerous tests led to the creation of an intermediary level that sits between the network and application levels. In cloud and fog computing, data is stored and processed at this layer, which is also known as the service layer. Authors like Ferrández-Pastor [63] have proposed a new architecture built on four tiers: objects, edge, communication, and cloud, for the past several years. The edge layer is used to detect essential apps and perform basic control actions in these current architectural solutions. Furthermore, cloud services, data storage, HMI interfaces, and analytic applications can all be found in the cloud (internet/intranet). Figure 9 depicts the building's layout.

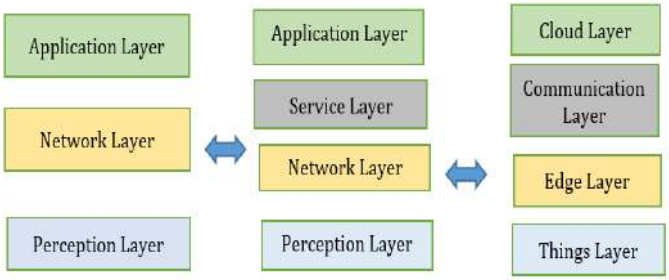


Figure 9. in IoT architecture, the development of layered models

It is possible to use both 3- and 5-layered irrigation IoT systems [64,65,66]. It is common to find sensor nodes and actuators on the lowest layer. Data transit is handled by the middle layer's gateway. The storage and processing of data often falls under the purview of the third and final layer. Third-layer services include things like databases and applications. IoT installations for precision agriculture are being considered in a novel way by the Internet of Underground Things [67]. It is suggested that architectural characteristics like sensors, machines and the cloud all work together in concert to provide in-situ sensing and wireless communication in underground spaces. In IoUT, sensors are tucked somewhere deep within the ground. In this study, the researchers investigated into wireless communication between equipment located above and below ground. The link between above ground and subterranean equipment experienced a loss of -80 dBm over a distance of 50 metres. The distance between buried devices at -80 dBm was approximately 10 metres. They also look into the impact of soil moisture on route loss.

Recommendations for Putting a Smart Agriculture Irrigation System in Place

An IoT irrigation system architecture has been proposed in this part by the researcher. The architecture of an IoT irrigation system for precision agriculture must be interoperable, scalable, secure, available, and robust to enable optimal performance. Accordingly, we've broken down our architecture concept as depicted in Figure 10,

which we refer to as "devices," "communication," "services," and "applications." In addition, management and security issues should be addressed simultaneously at the communication and service levels.

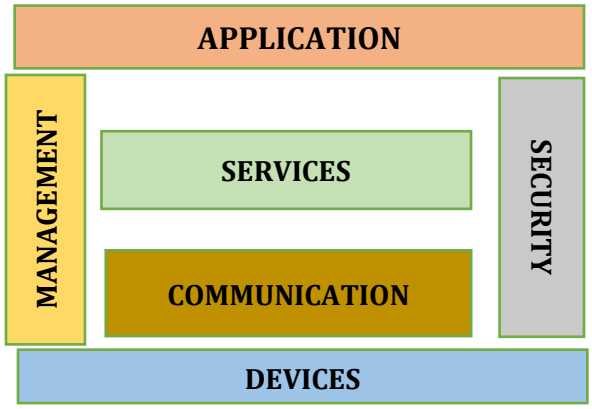


Figure 10. Architecture proposal for an IoT irrigation system for agriculture.

Finally, service block modelling and execution will be prompted by application execution in IoT-related business contexts. The communication and service tiers are both affected by management and security. There are four main components to this system's management: fault, configuration, accounting, and security (FCAPS). The ISO Telecommunications Management Network (67) is represented by this model. The four blocks of the security block protect the system's security and privacy. The authentication block is in charge of verifying the identity of both the user and the service. Access control policies are handled via the permission block. In addition, access control choices will be made in accordance with the regulations governing access control. The key exchange & management block is used to ensure secure peer-to-peer communication. As a last step, the trust & reputation block is in charge of determining how much the service may be trusted by a given user. The application layer is the final layer. Customers can use it to communicate with IoT devices. In this layer, the user can get alarms, see real-time data, and activate actuators or actions that have not been pre-programmed by the system.

India's IoT Farming Challenges

• Inadequate knowledge about the local climate.

• There aren't enough sales of distribution data sources to go around.

• Inadequate ICT infrastructure and illiteracy in the use of technology.

• Farmers are under-informed on the advantages of smart farming.

• Machinery for the workplace is expensive. There is a need for more manual labour. Keep a written record of all you've done.

• a scarcity of market research competence and a research centre.

• Changes brought on by the weather.

• Agriculture is attracting the attention of young and educated individuals who have no desire to work in the industry.

Limitations

- Agriculture is a phenomenon that is completely dependent on nature, and man can forecast or regulate nature, such as rain, drought, daylight convenience, and pest management, among other things. As a result, IOT systems are used in agriculture on a regular basis.
- Smart agriculture is constantly looking for ease on the internet. The rural areas of developing countries were unable to meet these needs. Furthermore, the internet is sluggish.
- Erroneous choices made by fault detectors or data processing engines waste water, fertiliser, and other resources.
- In order to practise smart farming, which relies heavily on the usage of instruments, the farmer must be familiar with and adept at using the technology. Introducing smart agriculture frameworks on a global scale could be the most challenging issue to overcome. It conjointly has some problems that ought to be half tracked properly to achieve the total good thing about it.

Conclusion

Water management is crucial in locations where water is scarce. This has an influence on agriculture, as agriculture consumes a substantial amount of water. Water management approaches are being studied in light of growing concerns about global warming in order it is necessary to ensure that water is available for agricultural production and consumption. As a result, the number of studies on irrigation water saving has grown over time. The current state of IoT irrigation systems is summarised in this study for agricultural. When it comes to deciding irrigation, soil, and weather water quality, we've discovered out what parameters are most strictly observed. The most widely utilised IoT and WSN crop irrigation nodes, as well as the most widely used wireless technologies, were also identified. The most current breakthroughs in the use of IoT technologies for crop management and irrigation were also presented. In addition, a four-layer crop irrigation management system has been developed. Based on the proposed architecture, we're creating a smart irrigation system that analyses water quality before irrigation.

As a result, we're expanding the system that can monitor crops in fields where humans can't provide protection. We're setting up a system in the field to keep track of valuable crops and ensure that all climatic requirements are met. In this place, we provide this type of system. As a result, this effective and dependable technology aids in agricultural monitoring. Aside from its core objective, the system makes a substantial contribution to global warming reduction. In a roundabout

approach, plants' normal instincts are impeded. This strategy can also be used to safeguard plants from being destroyed by a fire. As a result, crop damage is decreased. Consequently, the ecological equilibrium is preserved. Both an automated watering system and a field monitoring system are being developed as part of this project. This study's findings could propel agriculture to a new level of advancement.

References

1. Li, Li, Hu Xiaoguang, Chen, K. & He Ketai. (2011). The applications of Wi-Fi-based wireless sensor network in the internet of things and smart grid. In Industrial Electronics th and Applications ICIEA, 6 IEEE Conference on, 789-793. IEEE.
2. 2. Zhao, Ji-chun, et al. (2010). The study and application of IOT technology in agriculture. Computer science and rd information technology ICCSIT, 3 IEEE International Conference on, 2, 462-465. IEEE.
3. 3. TongKe, F. (2013). Smart Agriculture Based on Cloud Computing and IOT. Journal of Convergence Information Technology, 8(2), 2013.
4. Talpur, et al. (2012). Relevance of Internet of Things in Animal Stocks Chain Management in Pakistan's Perspectives. International Journal of Information and Education Technology 2(1).
5. Carvin, D., Philippe, O. & Pascal, B. Managing the upcoming ubiquitous computing. In Proceedings of the th 8 International Conference on Network and Service Management, 1276-280. International Federation for Information Processing.
6. P. Biber, U. Weiss, M. Dorna, and A. Albert. (2012). Navigation System of the Autonomous Agricultural Robot_`BoniRob'. [Online]. Available: http://www.cs.cmu.edu/~mbergerm/agrobotics2012/01Biber.pdf..
7. L. Zhang, I. K. Dabipi, andW. L. Brown, ``Internet of Things applications for agriculture,'' in Internet of Things A to Z: Technologies and Applications, Q. Hassan, Ed., 2018.
8. A. Tzounis, N. Katsoulas, T. Bartzanas, and C. Kittas, ``Internet of Things in agriculture, recent advances and future challenges,'' Biosyst. Eng., vol. 164, pp. 31_48, Dec. 2017.
9. 1. Koutroulis, A.G.; Papadimitriou, L.V.; Grillakis, M.G.; Tsanis, I.K.; Wyser, K.; Betts, R.A. Freshwater
10. vulnerability under high end climate change. A pan-European assessment. Sci. Total Environ. 2018,613, 271–286. [CrossRef] [PubMed].
11. Iglesias, A.; Santillán, D.; Garrote, L. On the barriers to adaption to less water under climate change: Policy choices in mediterranean countries. Water Resour. Manag. 2018, 32, 4819–4832. [CrossRef]
12. Zampieri, M.; Carmona García, G.; Dentener, F.; Krishna Gumma, M.; Salamon, P.; Seguini, L.; Toreti, A. Surface freshwater limitation explains worst rice production anomaly in india in 2002. Remote Sens. 2018,10, 244. [CrossRef]
13. Daskalakis, S.N.; Goussetis, G.; Assimonis, S.D.; Tenzeris, M.M.; Georgiadis, A. A uW backscatter-morse_leaf sensor for low-power agricultural wireless sensor networks. IEEE Sens. J. 2018, 18, 7889–7898. [CrossRef]
14. Guruprasadh, J.P.; Harshananda, A.; Keerthana, I.K.; Krishnan, K.Y.; Rangarajan, M.; Sathyadevan, S. Intelligent Soil Quiality Monitoring System for Judicious Irrigation. In Proceedings of the 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI), Udupi, India, 13–16 September 2017.
15. Parra, L.; Ortuño, V.; Sendra, S.; Lloret, J. Low-Cost Conductivity Sensor based on Two Coils. In Proceedings of the First International Conference on Computational Science and Engineering, Valencia, Spain, 6–8 August 2013.
16. Sendra, S.; Parra, L.; Ortuño, V.; Lloret, L. A Low-Cost Turbidity Sensor Development. In Proceedings of the Seventh International Conference on Sensor Technologies and Applications, Barcelona, Spain, 25–31August 2013.
17. Jain, S.; Vani, K.S. A survey of the automated irrigation systems and the proposal to make the irrigation system intelligent. Int. J. Comput. Sci. Eng. 2018, 6, 357–360. [CrossRef]
18. Joshi, A.; Ali, L. A Detailed Survey on Auto Irrigation System. In Proceedings of the IEEE Conference on Engineering Devices and Smart Systems, Tamilnadu, India, 3–4 March 2017.
19. Kansara, K.; Zaveri, V.; Slah, S.; Delwadkar, S.; Jani, K. Sensor based automated irrigation system with IOT:A technical review. Int. J. Comput. Sci. Inf. Technol. 2015, 6, 5331–5333.
20. A. Khanna and S. Kaur, "Evolution of Internet of Things (IoT) and its significant impact in the field of precision agriculture," Comput. Electron. Agricult., vol. 157, pp. 218_231, Feb. 2019.
21. A. Tzounis, N. Katsoulas, T. Bartzanas, and C. Kittitas, ``Internet of Things in agriculture, recent advances and future challenges,'' Biosyst. Eng., vol. 164, pp. 31_48, Dec. 2017.
22. P. V. Santhi, N. Kapileswar, V. K. R. Chenchela, and C. H. V. S. Prasad, "Sensor and vision-based autonomous AGRIBOT for sowing seeds," in Proc. Int. Conf. Energy, Commun., Data Anal. Soft Comput., Chennai, Tamil Nadu, Aug. 2017, pp. 242_245.
23. H. Karimi, H. Navid, B. Besharati, H. Behfar, and I. Eskandari, "A practical approach to the comparative design of non-contact sensing techniques for seed sow rate detection," Comput. Electron. Agricult., vol. 142, pp. 165_172, Nov. 2017.
24. Mohanraj I, Kirthika Ashokumar, Naren J, "Field Monitoring and Automation using IOT in Agriculture Domain" 6th International Conference on Advances in Computing & Communications, ICACC 2016, 6-8 September 2016, Cochin, India, Procedia Computer Science 93 (2016) 931 – 939
25. Mizunuma, M., Katoh, T., and Hata, S.I. (2003), Applying IT to farm fields a wireless LAN‖, NTT Tech. Rev, Vol. 1, pp.56-60.
26. Balakrishna K, (2020). Fusion Approach-Based

Horticulture Plant Diseases Identification Using Image Processing. In S. Chakraborty, & K. Mali (Eds.), Applications of Advanced Machine Intelligence in Computer Vision and Object Recognition: Emerging Research and Opportunities (pp. 119- 132). Hershey, PA: IGI Global.

27. Balakrishna K, & Rao, M. (2019). Tomato Plant Leaves Disease Classification Using KNN and PNN. International Journal of Computer Vision and Image Processing (IJCVIP), 9(1), 51-63.
28. Balakrishna K., (2020). WSN-Based Information Dissemination for Optimizing Irrigation Through Prescriptive Farming. International Journal of Agricultural and Environmental Information Systems (IJAEIS), 11(3).
29. N. Fathima, A. Ahammed, R. Banu, B.D. Parameshachari, and N.M. Naik, "Optimized neighbor discovery in Internet of Things (IoT)," In Proc. of International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT), pp. 1-5, 2017.
30. Doorenbos, J.; Pruitt,W.O. Guidelines for Predicting Crop. Water Requirements; FAO Irrigation and Drainage Paper; FAO: Rome, Italy, 1977; Volume 24, ISBN 92-5-100279-7.
31. 23. Allen, R.G.; Pereira, L.S.; Raes, D.; Smith, M. Evapotranspiración del Cultivo Guías Para la Determinación de los Requerimientos de Agua de los Cultivos; FAO: Rome, Italy, 2006; pp. 1–322.
32. CNR. Boletín N_ 6: Coeficiente de Cultivo; CNR: Santiago, Chile, 2010; pp. 1–7.
33. CNR. Boletín N_ 2: Programación de Riego Usando Estaciones Meteorológicas Automáticas; CNR: Santiago, Chile, 2010; pp. 1–14.
34. 26. Melillán, C. Evapotranspiración de Referencia. Para la Determinación de las Demandas de Riego en Chile. 2018. Available online: http://agrimed.wixsite.com/riego/evapotranspiracin (accessed on 27 May 2018).
35. 27. Agromet Red Agroclimática Nacional. Available online: http://agromet.inia.cl/ (accessed on 1 July 2017).
36. Gonzalez-Andujar, J.L., et al. (2006). "SIMCE: An expert system for seedling weed identification in cereals." Computers and Electronics in Agriculture, 54(2), 115-123. 7.
37. Andri, P., Siti, M.W. & Azhari. (2017). Expert System Model for Identification Pests and Diseases of Forest Tree Plantations, Int. J. Advance Soft Compu. Appl, 9(2), July. 8.
38. Evangelos A, et al. (2011). Integrating RFIDs and smart objects into Unified Internet of Things architecture. Advances in Internet of Things.
39. Chen, X.Y. & Zhi-Gang, J. (2011). Research on key technology and applications for the internet of things. Physics Procedia33(561-566). 10. Babu, MS Prasad. (2010). A web-based tomato crop expert information system based on artificial intelligence and machine learning algorithms.
40. Rubeena, J. & Gokilavani. (2019). Recent Survey on IOT Application: Smart Agriculture. IJIRAE: International Journal of Innovative Research in Advanced Engineering, 6(341-344).
41. Anand, N. & Er. V.P. (2016). Smart Farming: IOT Based Smart Sensors Agriculture Stick for Live Temperature and Moisture Monitoring using Arduino, Cloud Computing & Solar Technology. 13. Ramya. B, et al. (2018). A Survey on Smart Agriculture using Internet of Things.
42. Vesna Maras. Tomo Popovic. Spasenija Gajinov, Milena Mugosa, " Optimal Irrigation as a tool of Precision Agriculture," -14 JUNE 2019.
43. A. Algeeb, A. Albagul, A. Asseni, O. Khalifa, O.S Jomah. "Design And Fabrication Of An Intelligent Irrigation Control System".
44. K Balakrishna., Mahesh Rao and Y H Sharath Kumar., 2018. A WSN Application to Optimize the Irrigation for Horticulture Crops in Real-time using Climatic Parameters. Journal of Advance Research in Dynamical and Control Systems, Vol 10, pp. 199-207.
45. Tran Nguyen Baoanh and Su-Lim Tan., 2009. Real-Time Operating Systems for Small Microcontrollers. IEEE Micro, Vol 29, pp. 30-45.
46. Arumugam, S.S.; Ganeshmurthi, M.; Annadurai, R.; Ravichandran, V. Internet of things based smart agriculture. Int. J. Adv. Comput. Electron. Eng. 2018, 33, 8–17.
47. Boonchieng, E.; Chieochan, O.; Saokaew, A. Smart farm: Applying the use of node MCU, IOT, NETPIE and LINE API for a lingzhi mushroom farm in Thailand. IEICE Trans. Commun. 2018, 101, 16–23. [CrossRef]
48. Rawal, S. IoT based smart irrigation system. Int. J. Comput. Appl. 2017, 159, 7–11. [CrossRef]
49. Guo, T.; Zhong, W. Design and Implementation of the Span Greenhouse Agriculture Internet of Things System. In Proceedings of the 2015 International Conference on Fluid Power and Mechatronics, Harbin, China, 5–7 August 2015.
50. Khattab, A.; Abdelgawad, A.; Yelmarthi, K. Design and Implementation of a Cloud-based IoT Scheme for Precision Agriculture. In Proceedings of the 28th International Conference on Microelectronics, Giza, Egypt, 17–20 December 2016.
51. Nawandar, N.K.; Satpute, V.R. IoT based low cost and intelligent module for smart irrigation system. Comput. Electron. Agric. 2019, 162, 979–990. [CrossRef]
52. Barkunan, S.R.; Bhanumathi, V.; Sethuram, J. Smart sensor for automatic drip irrigation system for paddy cultivation. Comput. Electr. Eng. 2019, 73, 180–193. [CrossRef]
53. Parameswaram, G.; Sivaprasath, K. Arduino based smart drip irrigation system using internet of things. Int. J. Eng. Sci. Comput. 2016, 6, 5518–5521.
54. Kumar, A.; Surendra, A.; Mohan, H.; Valliappan, K.M.; Kirthika, N. Internet of Things based Smart Irrigation using Regression Algorithm. In Proceedings of the 2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Kannur, India, 6–7 July 2017.
55. Kodali, R.K.; Jain, V.; Karagwal, S. IoT based Smart Greenhouse. In Proceedings of the 2016 IEEE Region 10

Humanitarian Technology Conference (R10-HTC), Agra, India, 21–23 December 2016.
56. Abidin, S.A.H.Z.; Inrahim, S.N. Web-based Monitoring of an Automated Fertigation System: An IoT Application. In Proceedings of the IEEE 12th Malaysia International Conference on Communications, Kuching, Malaysia, 23–25 November.
57. Banumathi, P.; Saravanan, D.; Sathiyapriya, M.; Saranya, V. An android based automatic irrigation system using bayesian network with SMS and voice alert. Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol. 2017, 2, 573–578.
58. Padalalu, P.; Mahajan, S.; Dabir, K.; Mitkar, S.; Javale, D. Smart Water Dripping System for Agriculture/Farming. In Proceedings of the 2nd International Conference for Convergence in Technology (I2CT), Mumbai, India, 7–9 April 2017.
59. Laura García 1,2, Lorena Parra 1, Jose M. Jimenez 1,2 , Jaime Lloret 1,* and Pascal Lorenz 2, " IoT-Based Smart Irrigation Systems: An Overview on the Recent Trends on Sensors and IoT Systems for Irrigation in Precision Agriculture" Surveys of Sensor Networks and Sensor Systems Deployments)*Sensors* 2020, *20*(4),1042; https://doi.org/ 10.3390/s20041042.
60. Fernández, D.; Sánchez, P.; Álvarez, B.; López, J.A.; Iborra, A. TRIoT: A Proposal for Deploying Teleo-Reactive Nodes for IoT Systems. In Proceedings of the International Conference on Practical Applications of Agents and Multi-Agent Systems, Porto, Portugal, 21–23 June 2017.
61. González-Briones, A.; Castellanos-Garzón, J.A.; Mezquita Martín, Y.; Prieto, J.; Corchado, J.M. A framework for knowledge discovery from wireless sensor networks in rural environments: A crop irrigation systems case study. Wirel. Commun. Mob. Comput. 2018, 2018, 6089280.
62. Sebastian, S.; Ray, P.P. Development of IoT invasive architecture for complying with health of home. In Proceedings of the International Conference on Computing and Communication Systems (I3CS), Shillong, India, 9–10 April 2015.
63. Ferrández-Pastor, F.J.; García-Chamizo, J.M.; Nieto-Hidalgo, M.; Mora-Pascual, J.; Mora-Martínez, J. Developing ubiquitous sensor network platformusing internet of things: Application in precision agriculture. Sensors 2016, 16, 16–1141. [CrossRef]
64. Merezeanu, D.; Vasilescu, G.; Dobrescu, R. Context-aware control platform for sensor network integration in IoT and cloud. Stud. Inform. Control 2016, 25, 489–498. [CrossRef]
65. Robles, T.; Alcarria, R.; Martín, D.; Morales, A.; Navarro, M.; Calero, R.; Iglesias, S.; López, M. An Internet of Things-based Model for Smart Water Management. In Proceedings of the 28th International Conference on Advanced Information Networking and Applications Workshops, Victoria, BC, Canada, 13–16 May 2014.
66. González-Briones, A.; Castellanos-Garzón, J.A.; Mezquita Martín, Y.; Prieto, J.; Corchado, J.M. A framework for knowledge discovery from wireless sensor networks in rural environments: A crop irrigation systems case study. Wirel. Commun. Mob. Comput. 2018, 2018, 6089280.

Chapter

An IoT-based Immersive Approach to Sustainable Farming

Pratik Ghutke and Rahul Agrawal

Abstract

Despite the fact that the agricultural process is more data-driven, exact, and intelligent than ever before, the reality is that today's agriculture industry is more data-driven, precise, and intelligent than ever before, regardless of public perception. Virtually every industry has been altered by the rapid expansion of Internet-of-Things (IoT)-based technologies, including "smart agriculture," which has transitioned from statistical to quantitative methodologies. Such large advancements are upending conventional farming practises and offering new chances in the middle of numerous issues. A new paper looks at the promise of wireless sensors and the Internet of Things in agriculture, as well as the challenges that may occur when these technologies are integrated with traditional farming methods. Using Internet of Things (IoT) devices and communication protocols, wireless sensors utilized in agriculture applications are fully investigated. Sensors for soil preparation, crop status, irrigation, insect and pest detection, and other agricultural applications are on the list. From sowing to harvesting, packing, and transportation, this technique is explained. This article also discusses the use of unmanned aerial vehicles for agricultural monitoring and other useful purposes, such as crop yield optimization. When feasible, cutting-edge IoT-based agricultural ideas and systems are presented. Finally, we highlight present and future IoT trends in agriculture, as well as possible research challenges, based on this comprehensive analysis.

Keywords: internet-of-things (IoTs), smart agriculture, advanced agriculture practices, sensors

1. Introduction

Agriculture is the economic backbone of India. Since agriculture is our major source of sustenance, life would be impossible without it. The farmer needs to labour every day of the week to produce the harvest, which lowers his revenue, so he must look for alternative sources of food, especially since horticulture is becoming less popular. Mechanization is so critical in the rural cycle. Accordingly, this work proposed a framework so that livestock farmers could productively carry out their horticultural practices from remote locations while providing fewer ideal opportunities for farmland. In this framework, all the equipment works alone with the help of sources of information from sensors that are continuously checking the rural land, and

ranchers can screen whether everything is going well or some activity should have been done. The entire cycle is controlled and monitored by a programmable regulator. Solar primarily based power is the maximum considerable source of electricity inside the whole plants. Solar based electricity is not most effective a reaction to the contemporary electricity emergency, but additionally a sort of energy that is related to weather. The solar era is the era of efficient use of solar energy. Solar chargers (solar powers) are momently used to power street lights and water radiators.

1.1 Problem statement

The unexpected drop in the price of solar chargers is increasing their use in various fields. This innovation is used in horticultural water supply systems. Inside the cutting-edge nation of energy emergency in India, a solar powered water system infrastructure can be an inexpensive option for farm animals' farmers. it's far a conductive to imparting green energy that releases strength when the underlying is estimated. Water device design is a dangerous water detection method for the vicinity or soil that bureaucracy the primary basis of our yield shape. Water for the most element should be made available within the fields or through pits. This framework will lessen the responsibility of the rancher and hold enough soil pleasant for better development. From that factor on, the development was viable in that it introduced a ranch water system into the field, which quickly killed units. This mechanical fin is the entire structure of an electric water system washed out of the field. In term of GSM, there are two important developments in the water supply system. "GSM" is an arbitrary and basic moderator or handler. Global System for Mobile Communications (GSM) is a standard used to address infrastructure for mechanized data collection. Nowadays the agriculturist is focused on increasing output while keeping expenses down. This strategy necessitates an innovative approach to handle the problem and boost output and profitability while minimizing food production's environmental impact.

1.2 Research gap

Precision agriculture in the cultivation field necessitates several ecological criteria that indirectly analyze the aforementioned issue. However, because the intra-field variability in sugar beet production and quality is unknown, it must be assessed in terms of soil qualities and microclimate conditions. The crop environment's observed variability can therefore be managed by tailoring inputs to the places where they are needed. As a result, the precision agriculture model has been used and advanced in this study to track crop growth while taking into consideration field changes air temperature, soil moisture, soil type and other factors. Precision agriculture improves agricultural earnings and resource usage by reducing the use of traditional management practices.

1.3 Research objective

Precision farming has an impact on yield-based crop development depending on the soil type. Precision agriculture techniques have the potential to improve the Indian agricultural economy. The suggested research focuses on identifying limiting factors that have an impact on crop output. Providing precise water-based soil conditions predictions.

1.3.1 Irrigation system in India

In India, rural areas hold 18% of the US debt (GDP) and attract 49% of the workforce. According to records, 2022 of the military will be deployed in agricultural areas. 0205,000 siphons are continuously delivered to rural areas. Production of waste water devices, including siphon sets, uncontrolled water intake, unplanned water supply systems, water and energy savings, water loss and lack of expe.

Table 1 shows the effectiveness of different yields in India and the world. Unlike the general use of the world, India has a low yield potential. This is due to a decrease in the use of water in the water system as a result of the development of various misfortunes,

As shown in **Figure 1**. The repetition of dry season is increasing steadily, adversely affecting the usefulness of the crop. The dry season after that may be a repetition of the dry season, it is no shaggy dog story. The recurrence of drought in exceptional regions of India is proven in determine three. Streamlining water system productivity and electricity use is a vital take a look at inside the current water device state of

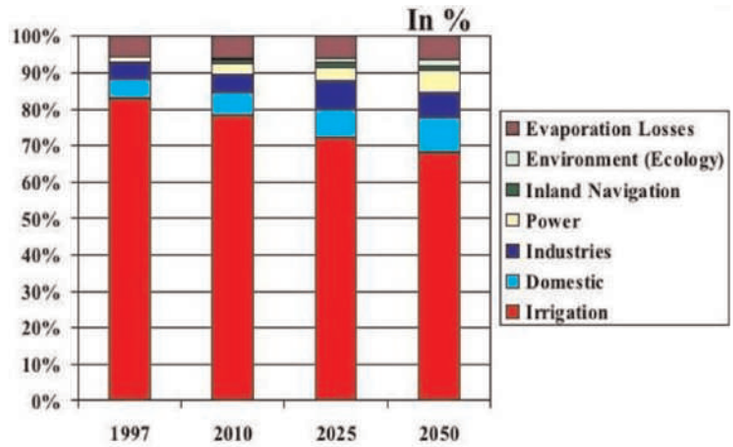


Figure 1.
Availability of water for irrigation [1].

Plant	India	World	Highest
Cotton	4.69	7.36	11.4 (China)
Maize	1.9	4.6	14.6 (Israel)
Oilseeds	0.87	1.87	4.09 (Germany)
Onions	10.7	17.8	46.8 (USA)
Paddy	2.97	3.9	8.9 (Egypt)
Potato	19.6	15.9	48.6 (Belgium)
Pulses	0.59	0.9	4.6 (Netherland)
Soya	0.95	2.34	3.58 (Turkey)
Sugarcane	69	63	1.17 (Zimbabwe)
Tomato	16.5	26.8	61.9 (USA)
Wheat	2.76	2.88	7.9 (Germany)

Table 1.
Crop productivity (MT/ha).

affairs. Controlling using water sources is extremely fundamental to reap maximum core yield in higher energy use. Maintaining water device efficiency is extremely challenging. The effectiveness of a water device is the ratio of water utilized by the dust to the filth that is distributed through the water system. The effectiveness of the water device has to be cohesive, i.e., the water utilized by the filth and the contribution of water to the effluent via the water device ought to be same. If the performance of the water system is more prominent than the consent, the structure of the water device cannot satisfy the dirty water hobby. If the efficiency of the water unit is not as high as the clutch, this redundancy is supplied by using the water machine structure, which induces wastage of water.

The water system's structure is prone to large amounts of water catastrophe, reducing the effectiveness of the water system. What's more, the water system productivity of the different structures is analyzed, given in **Table 2**.

Here in **Figure 2**, Experts are baffled by the frequency of droughts shown in official data. According to the agriculture ministry's drought management section, Assam would experience a drought-like condition once every 15 years. However, the trend shows that the state has had three droughts in the last 9 years (including this year). Though Bihar and Uttar Pradesh are only vulnerable once every 5 years, the state has seen three drought-like circumstances in the last 5 years, while Uttar Pradesh has experienced two. The statistics for the southern states, particularly Karnataka and Andhra Pradesh, are considerably more mixed. While the states have had numerous droughts in the last 5 years, a study suggests that Karnataka is vulnerable once every 5 years and Andhra Pradesh twice every 5 years.

1.3.2 Factors responsible for low productivity

Existence of Big Farmers: Even though India's Zamindari system has been abolished, rural large farmers continue to play a shadow role. These large landowners control rent, tenure, tenancy rights, and other aspects of renters' lives. As a result, the situation of tenants is deteriorating day by day. It is quite difficult to increase productivity using solely modern technologies in this type of tenure structure.

High Land-Man Ratio: Huge demographic pressures characterize Indian agriculture. According to the 2001 Census, over 72.2 percent of the entire population lived in rural areas, with agriculture employing nearly three-quarters of the total rural working population, or nearly 228 million employees (out of 310.7 million workers).

Sources of losses	Leakages	Evaporation	Total
Canals & Branch Canals	13.6	3.4	17.0
Distributaries	6.4	1.6	8.0
Water Courses in the Field	16.0	4.0	20.0
Field application Losses	13.2	3.3	16.5
Total	49.2	12.3	61.5
Comparative Efficiency of Irrigation System			
Surface 30–40%			
Sprinkler 60–70%			
Drip Irrigation 80–90%			

Table 2.
Water losses in percentage in India.

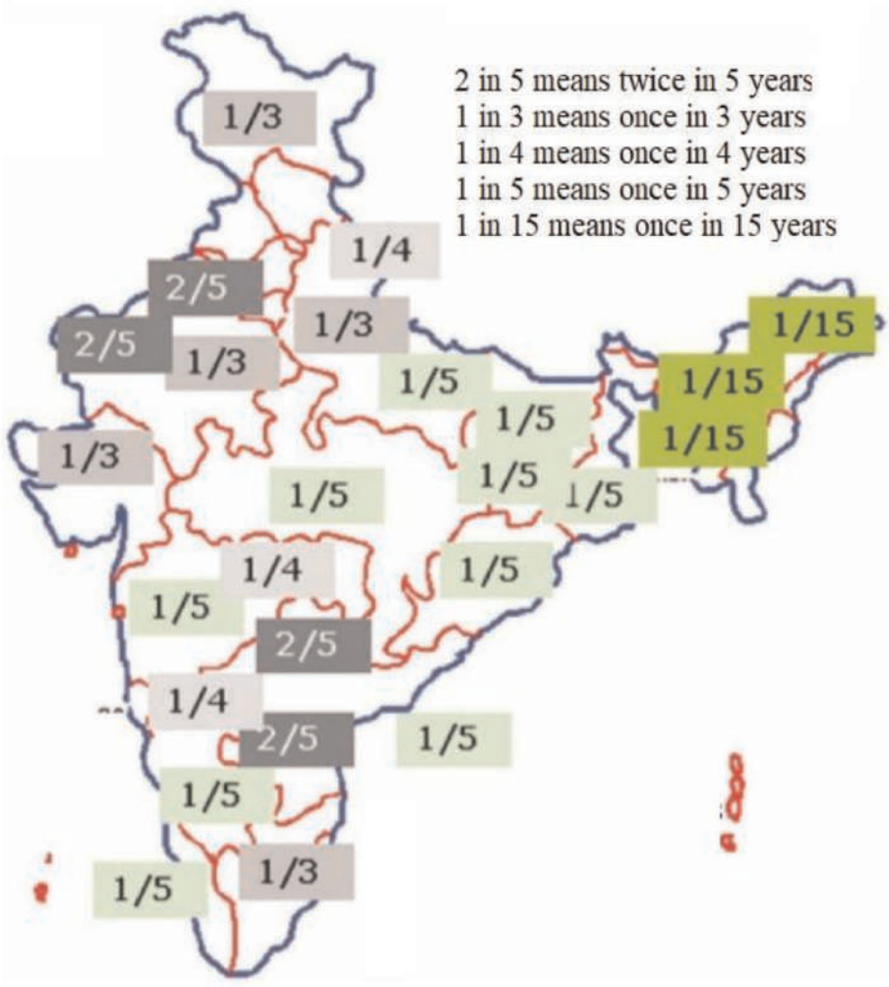


Figure 2.
Frequency of occurrence of drought in various parts of country.

Uneconomic land subdivisions occur as a result of population growth. All of these factors contribute to low production.

Rural Environment: In India, the rural social milieu is a major contributor to low productivity. Farmers in India are lethargic, illiterate, superstitious, have a primitive outlook, are conservative, unfit, and resistive to modern farming methods. Farmers' marginal productivity in agriculture is zero, due to the family-based farming method. Credit and marketing facilities that are irregular and insufficient: According to Raj Krishna's research, poor farmers are unable to effectively spend money in the land during the peak season of agriculture due to a lack of and insufficient availability of agricultural loans at a low rate of interest. Furthermore, crop marketing is regulated by intermediaries or touts. As a result of all of this, agricultural productivity was low. Modern technologies are lacking: In India, over 60% of cultivable land lacks irrigation facilities. In 2000–2001, only 75.14 million hectares (out of 87.94 million hectares) were irrigated. As a result, the green revolution's 'Package Program' is ineffectual across the vast majority of India's gross cultivated areas. Degradation of the Ecosystem: According to the Indian government, 329 million hectares (almost half of the country's land) have already been degraded. This leads to a yield loss of 33 to 67%. Furthermore, 5% of the land has been ruined to the point where it can no longer be utilized.

Figure 3 shows that interest in this issue has grown over time as measured by the number of papers published every year. The smaller number of papers for 2019 is

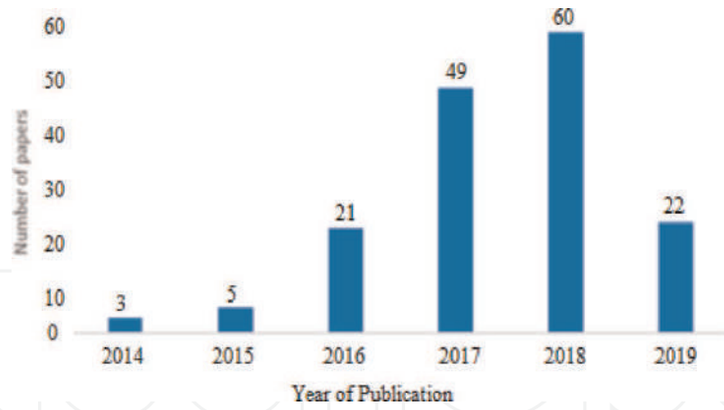


Figure 3.
Annual number of articles presenting IoT irrigation systems that have been published [2].

owing to the fact that the year was not quite through when the paper selection procedure was concluded. As a result, not all of the papers written in 2019 have been published.

1.3.3 Water management

There are various ways to distribute water irrigated agriculture is a type of agriculture that uses water as a source of input. The effectiveness of the various possibilities varies, in some circumstances, a specific technique for a given crop should be adopted. Irrigation can be done in a variety of ways, but they can all be categorized into the following groups: When it comes to how water is spread, we can examine the flood irrigation, (ii) spray irrigation, (iii) drip irrigation, and (iv) nebulizer irrigation. On the subject of sensing systems, we can discuss I unplanned irrigation, in which the amount of water is not calculated or estimated; (ii) planned irrigation, in which the water is supplied according to estimated demands over a year; and (iii) adhoc irrigation, in which the amount of water is estimated based on sensor readings. The great majority of the papers in this section propose to distribute water using pumps and valves in conjunction with sensors that assess ambient conditions in order to determine water needs. In this part, 83 of the 89 reviewed articles include detailed information about the planned irrigation system, while the remaining six just state that irrigation actuators are present (see **Figure 4**). There are 49 articles that just indicate that their system has motors/pumps (40 papers) or valves (nine papers) without providing any additional information. 19 of the studies that provide additional information use sprinklers (the most common irrigation technique) [3–21], eight utilize drip irrigation [22–30], two propose sprayers [22, 31], and the rest use highly specialized irrigation systems or it can be used on multiple systems [32]. Three papers [16, 18, 27] suggest using a fogging system in conjunction with the main irrigation system, whereas two papers [17, 28] suggest using fertigation in their systems.

1.3.4 Major applications

Every aspect of traditional agricultural methods can be significantly transformed by incorporating cutting-edge sensor and Internet-of-Things (IoT) technologies into farming practises. Smart agriculture has the potential to reach previously unimagined heights thanks to the current seamless integration of wireless sensors and the Internet

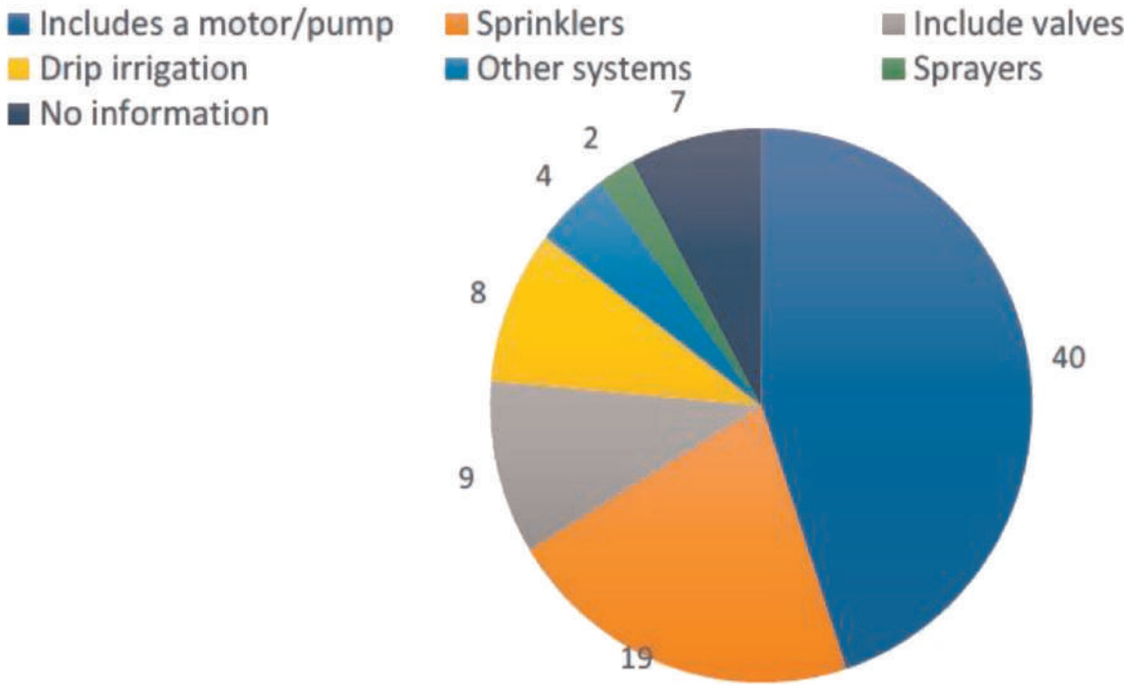


Figure 4.
Number of papers that propose different irrigation systems [2].

of Things. By utilizing smart agriculture approaches, IoT can help improve answers to many traditional farming difficulties, such as drought response, yield optimization, land suitability, irrigation, and insect management. **Figure 5** depicts a hierarchy of critical applications, services, and wireless sensors in smart agriculture applications. While key examples of how modern technology might aid in improving overall efficiency at various levels have previously been covered.

The Internet of Things (IoT) is beginning to affect a wide range of sectors and companies, spanning from manufacturing to health, communications, energy, and agriculture, in order to reduce inefficiencies and improve performance across all markets. When you think of the word, two words come to mind: [34, 35]. Current applications appear to be simply scraping the surface of IoT's potential, with the full extent of its influence and applications still to be seen. Given the recent increase, we may expect IoT technology to play a vital role in a number of agricultural applications. This is due to the capabilities of the Internet of Things, which include basic communication infrastructure (used to connect smart objects to sensors, vehicles to user mobile devices via the Internet), as well as a variety of services such as local and remote data collection, cloud-based intelligent information analysis and decision making, user interfacing, and agriculture operation automation. Such people have the power to change agriculture, which is currently one of our economy's least efficient sectors. **Figure 6** displays the important technology drivers in smart agriculture, whereas **Figure 7** depicts the major technological implementation roadblocks.

1.3.5 Demand for water

The water demand of the irrigation system is determined by estimating the amount of water required for best crop output. The estimated crop evapotranspiration (ETc) is used to determine the water demand; however, estimating the ETc requires knowledge of the reference evapotranspiration (ET0). ET0 was defined by Dorenbos

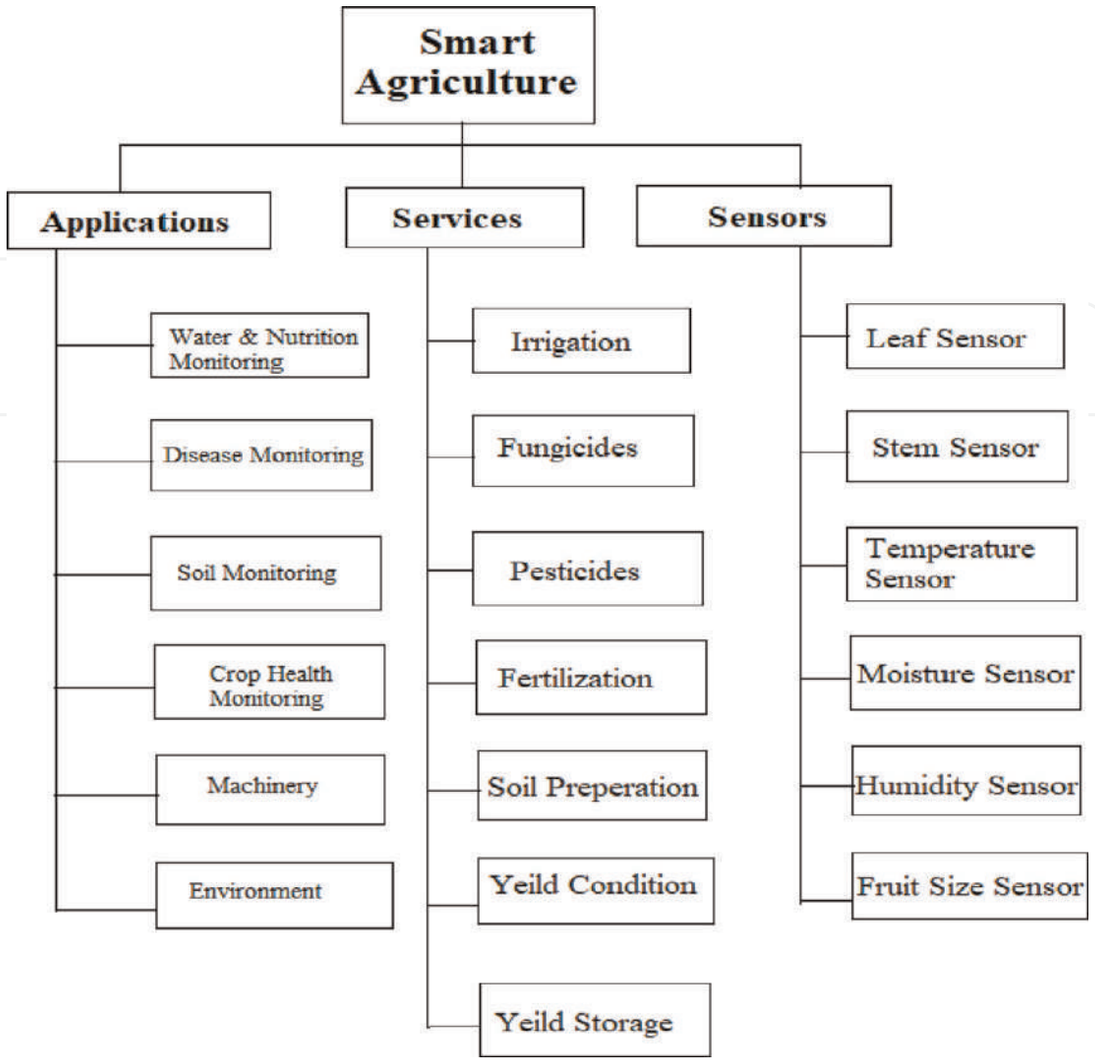


Figure 5.
A hierarchy of applications, services, and sensors exists for smart agriculture [33].

Figure 6.
Major challenges in technology implementation for smart agriculture [33].

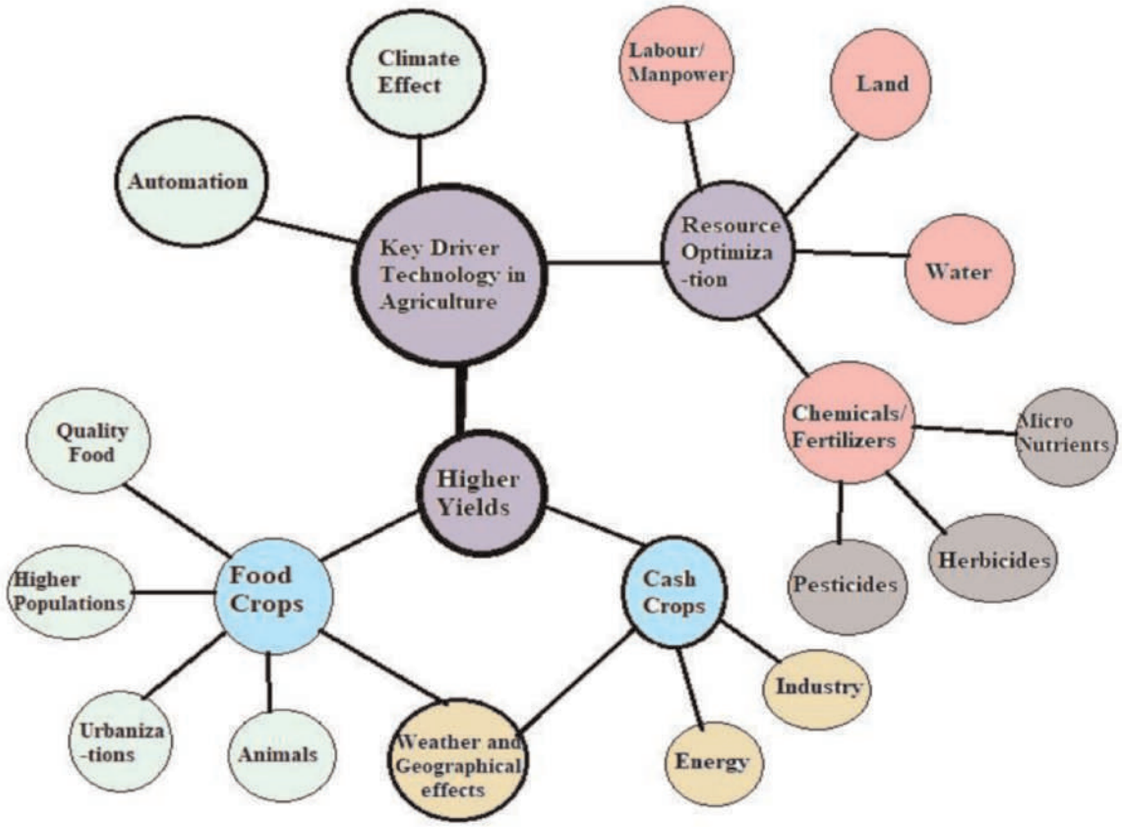


Figure 7.
The agricultural industry's key technological drivers [33].

and Pruitt [36] as a result of the total amount of under ideal conditions, water evaporated from the soil and a large area of grass-covered ground transpired a large amount of water (vigorous development and unrestricted access to water). The Penman–Monteith equation is the most extensively utilized approach [37], was used to calculate ET0, as illustrated below [2].

$$ET0 = \frac{0.408\,\Delta\,(Rn - G)\,\frac{900\,\gamma\,u2\,(es-ea)}{T}}{\Delta + \gamma\,(1 + 0.34u2)} \quad (1)$$

The ET0 value is measured in millimeters per day, Rn is the net solar radiation incident on the crop surface, G is the soil heat rate (MJ/(m^2day)), is the psychrometric constant (kPa/C), u2 is is the steam pressure slope, expressed in kPa/C. is the wind velocity recorded at a height of two metres, es is the saturated steam pressure, and ea. is the actual steam pressure, all in kPa. Agrometeorological stations measured all climate factors to determine ET0, which is dependent on wind speed, sun radiation, air temperature, and relative humidity.

ETc was calculated using ET0 and the crop coefficient as inputs (Kc). The type of crop, the climatic circumstances, the soil's distinctive features, and the vegetative phase are all taken into account by Kc. The CNR (Chilean Irrigation Commission) bulletins [38, 39], as well as the paper headed "Reference Evapotranspiration, for the Determination of Water Demands for Agriculture in Chile" [40], tabulate values for each species and growth phase. Eq. (2) was used to compute crop evapotranspiration, ETc, where ET0 was changed based on the crop coefficient:

$$ET_c = K_c ET_0 \tag{2}$$

The crop coefficient is Kc, while ET0 is measured in millimeters per month (millimeters per month). The monthly net water demand was calculated using the Eq. (ND). ND is calculated using the difference between ETc and the crop's effective rainfall (Pe). ND refers to the water required by the crop's roots from the irrigation system.

$$ND = ET_c – P_e \tag{3}$$

The United States Department of Agriculture's Natural Resources Conservation Service (NRCS) developed a method for calculating Pe based on real rainfall [36]. It was estimated in this study using the monthly average of actual rainfall data from the national agroclimatic network (Agromet) [41]. Because any irrigation system water losses must be compensated, the irrigation system must provide more water than the net water demand (ND). Certain security elements were also implemented to ensure that the crop received at least the ND. The effects of deep percolation and surface runoff are factored into the drip irrigation system's application effectiveness (Ea), which was determined to be 90% efficient. Two further elements that influence water demand are the washing requirement (RL) and the coverage coefficient (Kr). The minimal amount of percolation water required to maintain a constant soil salinity and avoid an increase in salinity that could stymie crop development is known as RL. Water does not require to be applied to the entire anticipated surface of the crop when Kr is used. The value of Kr is determined to be less than or equal to unity. Equation shows the water requirement [2].

$$D = \frac{ND\ (1 + Rl)\ Kr}{Ea} \tag{4}$$

The irrigation schedule specifies how frequently and for how long water must be provided to the crops. The irrigation frequency interval and volume of water provided are determined by the amount of water kept in the root zone of the crops and how quickly it is consumed. The soil texture, soil structure (water percolation), effective root zone depth, crop type, and crop growth stage all influence irrigation frequency [3]. For high-frequency watering requirements, a short interval is defined (one, two, or more days). The goal is to maintain a consistent soil humidity [4]. The annual irrigation schedule, which detailed the frequency of irrigation for each month, was presented by an irrigation consultant. The daily irrigation demand (RID) in liters was calculated using Eq. (5) once the irrigation calendar was defined.

$$\text{RID} = \frac{DAc}{Di} \tag{5}$$

where Di is the number of irrigation days each month and Ac is the number of hectares of land covered by the crops. Ac was calculated using Eq. (6), which took into consideration the surface of each plant frame (PF) as well as the quantity of plants (Nplants)

$$A_c = PFN_{plants} \tag{6}$$

The length of time (ti) for which an irrigation system may run in order to provide enough water to meet the needs of the crops was determined using Eq. (7).

$$ti = \frac{RID}{qeNe} \tag{7}$$

where q_e is the volume flow rate supplied by the emitters in liters per hour, and N_e is the number of emitters [2].

1.3.6 Irrigation System's electricity demand

Drip irrigation, a water-saving irrigation technique that distributes water to crops through a pressurized network of valves, pipelines, and emitters, is one of the most widely used irrigation systems. The irrigation system pump is chosen based on the irrigation system head (necessary pumping pressure) and the amount of water that the crops demand. The irrigation system head takes into account the elevation head, the pressure drop due to friction in the pipes and singularities (i.e., valves), and the required working pressure by the emitters. The pump's electrical demand remains constant since the pumps in this study deliver a constant volume flow rate. Other research [5, 6, 42] suggested using a variable speed pump to modify water flow in response to changes in solar radiation, allowing for an enhanced irrigation regime. A control system that aligns water supply with solar radiation could aid energy optimization [7], particularly in off-grid environments; however, this option is not explored in this study. The optimal design achieves the lowest overall cost, which includes the operational cost (electricity cost) of pumping, which lowers as the pressure drop decreases, as well as the capital cost of the irrigation system. Pipe friction and singularity losses in valves and fittings are used to compute the pressure drop. The pressure reduces as the pipe diameter increases, cutting the operational cost; nevertheless, the capital cost climbs in lockstep. Reduced pressure loss can also be helped by selecting the right emitters and filters.

The pumping system was designed to manage the worst-case scenario, which occurred during the peak water demand month. The operational characteristics of the pump were determined using the pump characteristic curve, which was produced during an experimental standard test. The pump characteristic curve provided information on the system head (H), pump efficiency (), and electrical power required by the pump (Wp) as a function of the pumped volume flow rate of water (Q). Eq. (8) was used to calculate Wp:

$$Wp = \frac{Q\rho gH}{\eta p \eta m} \tag{8}$$

where ηp denotes the efficiency of a mechanical pump and m denotes the efficiency of an electric motor. In general, ηp was between 90 and 95 percent, and m was between 45 and 65 percent. Some high-efficiency pumps can attain up to 85 percent total pump efficiency (ηp ηm). Eq. (9) was used to compute the daily electricity requirement (Ed) once Wp was estimated (from Eq. (8):

$$E_d = W_p t_i. \tag{9}$$

1.3.7 Solar PV system design

Irrigation water demand is frequently seasonal, throughout the year, the PV system generates electricity. The solar PV system should be able to deliver the electricity required by the irrigation system in order to ensure a uniform distribution of the volume flow rate of water required by all crops. Reliable data on solar resources is

required for proper PV system design. In this investigation, the Solar Explorer, an online tool developed by Chile's Ministry of Energy [10], was used. The Solar Explorer's solar PV model is used in this study. It's based on a Sandia National Laboratories model, which is outlined in the reference. Solar radiation data for each unique location was also collected using the Solar Explorer, which was then incorporated in the solar PV model. The reference goes into great detail on the radiation database and its accuracy. Internet of Things Research: Key Technology and Applications In this paper, the author discusses the importance of IoT and RFID. With proper administration and dependable transmission, IOT can connect all items anywhere, at any time. There are several strata to be found.

1. Layer of Access: Data is transferred from the sensing layer to the network layer via this layer.

2. Network Layer: To pool the knowledge resources of the network.

3. Layer of Middleware: To deal with real-time data processing.

4. Layer of Application: To combine the functions of the bottom system. In this work, RFID technology is utilized to distinguish enemy aircraft by machine. RFID devices can also be used for inventory control, transportation, high security, and high irresponsibility. One of RFID's most essential elements is antenna technology.

2. Common architecture designs for IoT irrigation systems in agriculture

This section will provide an overview of the most popular architectures for these systems. In IoT irrigation management solutions, multi-agent architectures are widespread [43, 44]. These structures provide a distinction between the numerous components that make up its structure. The difference is typically made depending on the architectural strata in which the elements are housed. For example, nodes higher in the hierarchy may act as a broker for nodes lower in the hierarchy [43]. The most of of designs are divided into layers or functional blocks that represent the main tasks that must be done [45]. These blocks or layers are considered generic and are found in the majority of IoT irrigation management system architectural designs. The essential components of these architectures are devices, connectivity, services, administration, applications, and security. IoT systems are made up of devices that are put in a specific location and may perform activities including detection, monitoring, control, and action. In order to convey the essential data, the devices must have interfaces that allow them to communicate with other devices. The information gathered by various sensors will be treated as a whole, and the results will be applied to various actuators. The data collected and the actions taken must then be sent between the devices. The use of communication protocols is required for this task. In the majority of circumstances, different communication protocols are used on the same IoT system in order for it to work together. Services may be required to complete tasks such as device discovery, device control, and data analysis. The user can interact with the system using the programmes. The user will be able to see data acquired through monitoring as well as data extracted once it has been processed utilizing the applications. On numerous occasions, the user can execute actions that he considers relevant to the scenario presented by the data, and the actions can also be performed automatically.

Finally, the security of the system may be considered. The three layers of IoT architecture have typically been believed to be perception, network, and application. After several research, an intermediary layer was built between the network and application levels. In cloud and fog computing environments, this layer, also known as the service layer, is used to store and process data. For the past few years, authors such as Ferrández-Pastor [46] have proposed a new architecture based on four layers: objects, edge, communication, and cloud. In their current architectural proposals, the authors use the edge layer to locate critical apps and perform basic control activities. According to [46], cloud (internet/intranet) can also include Web services, data storage, HMI interfaces, or analytic applications. An illustration of the architecture models is shown in **Figure 9**. These designs in Sensors 2020, 20, x 34 of 48, include devices, communications, services, administration, applications, and security. IoT systems are made up of devices that are put in a specific location and may perform activities including detection, monitoring, control, and action. To transfer the essential data, the devices must have interfaces that allow them to communicate with other devices. The information gathered by numerous sensors will be processed in general, and the results will be applied to various actuators. The observed data as well as the response actions must then be sent between the devices. Communication protocols are required for this task. In the majority of circumstances, different communication protocols are used on the same IoT system in order for it to work together. Services may be required to complete tasks like device discovery, device control, or data analysis. The programs enable the user to interact with the system. The user will be able to visualize information collected through monitoring as well as information taken from data after it has been processed using the applications. On numerous occasions, the user can take actions that he considers important to the scenario presented by the data, and these actions can also be taken automatically. Finally, assess the system's security. Traditionally, the three layers of IoT architecture have been thought to be perception, network, and application. Following several research, an intermediary layer between the network and application layers was built. In cloud and fog computing environments, this layer, also called the service layer, is used to store and process data. For the past several years, authors like Ferrández-Pastor [46] have proposed a new architecture that is built on four layers: objects, edge, communication, and cloud. In these current architectural methods, the authors employ the edge layer to locate critical apps and perform basic control operations. According to [46], cloud (internet/intranet) can also include Web services, data storage, HMI interfaces, or analytic applications. **Figure 8** shows a representation of the architecture.

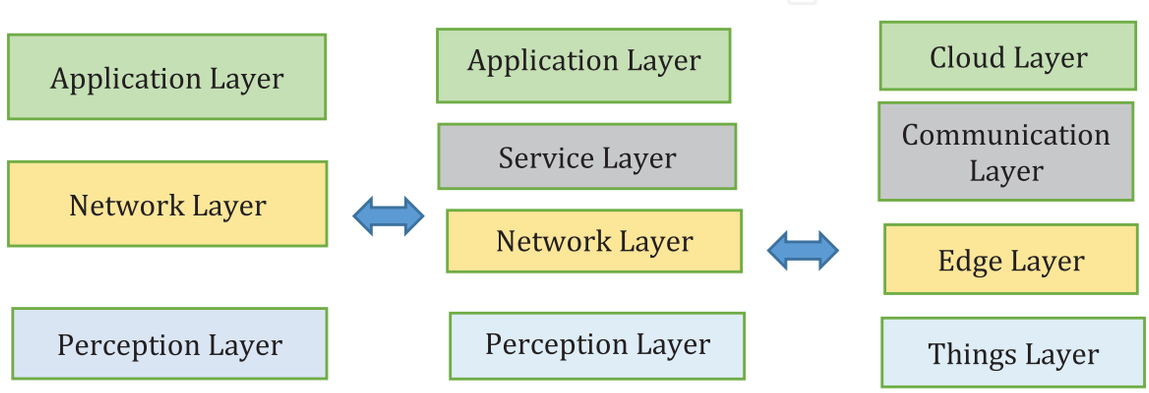


Figure 8.
Evolution of the layered model in IoT architecture [2].

Both 3-layered [43, 47] and 5-layered [48] designs are accessible in the assessed IoT systems for irrigation. The sensor nodes and actuators are usually found in the lowest layer. The middle layer has a gateway and is concerned with data transport. Finally, the third layer is often responsible for data storage and analysis. Cloud services, databases, and applications are common examples of third layers. The Internet of Underground Things [33] is considering an innovative approach to IoT deployments for precision agriculture. In-situ sensing, wireless communication in underground environments, and the interaction between architectural features like sensors, machinery, and the cloud are all identified as functions by the authors. In the case of IoUT, sensors are implanted underground. Wireless communication between above-ground and beneath devices was examined by the researchers. The route loss link between above ground and subterranean devices achieved −80 dBm over a distance of 50 metres. The distance between underground devices for −80 dBm was roughly 10 m. The authors also explore the impact of soil moisture on route loss.

2.1 Recommendations for putting a smart agriculture irrigation system in place

In this section, the researcher has presented an architecture suggestion for an IoT irrigation system. To ensure the optimal functioning of the IoT irrigation system for precision agriculture, the architecture should provide interoperability, scalability, security, availability, and robustness. Following a thorough analysis of other researchers' work, we have divided our architecture concept into four tiers, as shown in **Figure 9**, which we refer to as devices, communication, services, and applications. Furthermore, the communication and services levels should solve management and security concerns at the same time.

The first layer is the Device layer, which includes all of the devices that will perform detection, monitoring, control, and action functions. There would be four types of nodes in total. The water quality would be checked at the water monitoring node to verify if it was suitable for crop irrigation. The soil monitoring node would

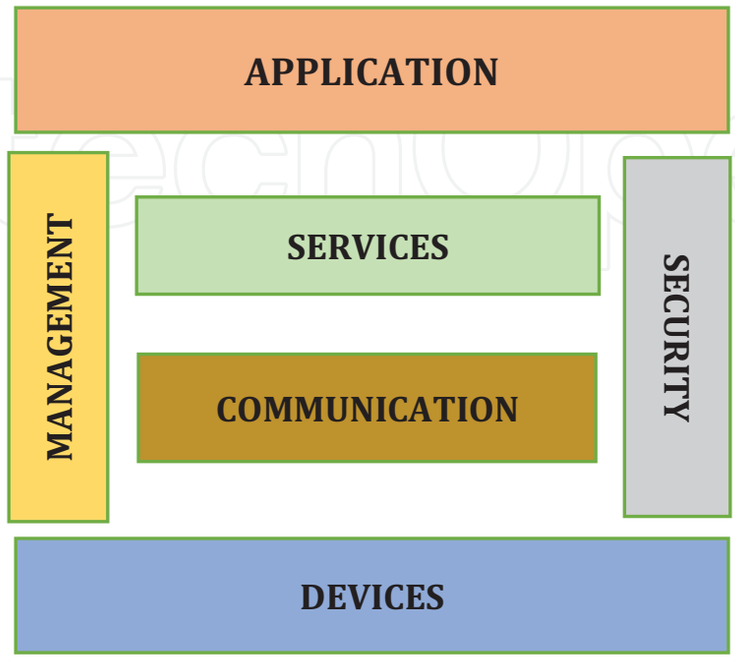


Figure 9.
Architecture proposal for an IoT irrigation system for agriculture [2].

monitor soil moisture, temperature, and other parameters, which would contribute in the irrigation schedule decision-making process. The weather monitoring node would measure air temperature and humidity, precipitation, luminosity, radiation, and wind parameters to facilitate decision-making. Finally, the decision-making process's operations would be carried out by the actuator nodes. The second layer is the communication layer, which has three blocks. The Hop-to-Hop communication block allows for the design of data link layer technologies as well as frame transmission with device layer data. In order to reach far-flung sites, frames will be transmitted from this block to the network communication block. The routing function may be assumed in this block in mesh networks, such as 802.15.4 networks. The end-to-end communication block is responsible for delivering the capabilities of the TCP/IP model's transport and application layers when communication spans various network contexts. Finally, the network communication block is responsible for network communication (routing), hop-to-hop communication at end-to-end blocks using IPv4 and IPv6 addresses, as well as ID resolution. It will also be in charge of overseeing service quality. The following layer is the services layer, which consists of three blocks. The services section includes IoT services as well as the ability to discover and search for them. Users are assigned services by the organization block based on their needs or available resources. Finally, in IoT-related business environments, service block modeling and execution will be triggered by application execution. Management and security are two elements that work on both the communication and service tiers. The management block is built using the fault, configuration, accounting, performance, and security (FCAPS) idea and architecture. This model represents the ISO Telecommunications Management Network [33]. The security block, which consists of four blocks, ensures the security and privacy of the systems. User and service authentication are handled by the authentication block. The authorization block is in charge of access control policies. Furthermore, access control decisions will be made based on access control regulations. To provide secure peer-to-peer communication, the key exchange & management block is used. Finally, the trust & reputation block is responsible for scoring the user and evaluating the level of trust in the service. The final layer is the application layer. It allows customers to interact with IoT technologies. This layer allows users to receive alarms, see acquired data in real time, and trigger actuators or actions that have not been configured automatically.

2.2 India's IoT farming challenges

- Inadequate knowledge about the local climate.
- There aren't enough sales of distribution data sources to go around.
- Inadequate ICT infrastructure and illiteracy in the use of technology.
- Farmers are under-informed on the advantages of smart farming.
- Machinery for the workplace is expensive. There is a need for more manual labour. Keep a written record of all you have done.
- a scarcity of market research competence and a research centre.

- Changes brought on by the weather.

- Agriculture is attracting the attention of young and educated individuals who have no desire to work in the industry.

2.3 Limitations

- Agriculture is a phenomenon that is completely dependent on nature, and man can forecast or regulate nature, such as rain, drought, daylight convenience, and pest management, among other things. As a result, IOT systems are used in agriculture on a regular basis.

- Smart agriculture is constantly looking for ease on the internet. The rural areas of developing countries were unable to meet these needs. Furthermore, the internet is sluggish.

- Fault detectors or data processing engines can lead to erroneous decisions, resulting in waste of water, fertilizers, and other resources.

- Smart farming, which is mostly based on instrumentation, necessitates that farmer understand and learn how to use technology. This could be the most difficult obstacle to overcome in implementing smart agriculture frameworks on a large scale across countries.

- It conjointly has some problems that ought to be half tracked properly to achieve the total good thing about it.

3. Conclusion

Water management is crucial in locations where water is scarce. This has an influence on agriculture, as agriculture consumes a substantial amount of water. Water management approaches are being studied in light of growing concerns about global warming in order it is necessary to ensure that water is available for agricultural production and consumption. As a result, the number of studies on irrigation water saving has grown over time. In this paper, we present a summary of the current state of the art in IoT irrigation systems for agricultural. When it comes to deciding irrigation, soil, and weather water quality, we have discovered out what parameters are most strictly observed. The most widely utilized IoT and WSN crop irrigation nodes, as well as the most widely used wireless technologies, were also identified. The most current breakthroughs in the use of IoT technologies for crop management and irrigation were also presented. In addition, a four-layer crop irrigation management system has been developed. Based on the proposed architecture, we are creating a smart irrigation system that analyses water quality before irrigation.

As a result, we are expanding the system that can monitor crops in fields where humans cannot provide protection. We're setting up a system in the field to keep track of valuable crops and ensure that all climatic requirements are met. In this place, we provide this type of system. As a result, this effective and dependable technology aids in agricultural monitoring. Aside from its core objective, the system makes a substantial contribution to global warming reduction. In a roundabout approach, plants'

normal instincts are impeded. Plants can also be protected from fire using this method. Crop destruction is reduced as a result. As a result, the ecological balance is maintained. The research develops both an automatic watering system and a field monitoring system. The results of this study would catapult farming to another developmental level.

Author details

Pratik Ghutke[1*] and Rahul Agrawal[2]

1 Tulsiramji Gaikwad Patil College of Engineering and Technology, Nagpur, India

2 Guru Gobind Singh College of Engineering and Research Center, Nashik, India

*Address all correspondence to: pcghutke2214@gmail.com

References

[1] Carvin D, Philippe O, Pascal B. Managing the upcoming ubiquitous computing. In: 2012 8th International Conference on Network and Service Management (CNSM) and 2012 Workshop on Systems Virtualiztion Management (SVM). International Federation for Information Processing; 2012. pp. 276-280

[2] Fernández D, Sánchez P, Álvarez B, López JA, Iborra A. TRIoT: A proposal for deploying Teleo-reactive nodes for IoT systems. In: Proceedings of the International Conference on Practical Applications of Agents and Multi-Agent Systems, Porto, Portugal. MDPI; 21–23 June 2017

[3] Fathima N, Ahammed A, Banu R, Parameshachari BD, Naik NM. Optimized neighbor discovery in internet of things (IoT). In: Proceedings of International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT). IGI Global Publisher; 2017. pp. 1-5

[4] Doorenbos J, Pruitt WO. Guidelines for Predicting Crop. Water Requirements; FAO Irrigation and Drainage Paper. Vol. 24. Rome, Italy: FAO; 1977

[5] Allen RG, Pereira LS, Raes D, Smith M. Evapotranspiración del Cultivo Guías Para la Determinación de los Requerimientos de Agua de los Cultivos. Rome, Italy: FAO; 2006. pp. 1-322

[6] CNR. Boletín N_6: Coeficiente de Cultivo. Santiago, Chile: CNR; 2010. pp. 1-7

[7] CNR. Boletín N_2: Programación de Riego Usando Estaciones Meteorológicas Automáticas. Santiago, Chile: CNR; 2010. pp. 1-14

[8] Melillán, C. Evapotranspiración de Referencia. Para la Determinación de las Demandas de Riego en Chile. 2018. Available from: http://agrimed.wixsite.com/riego/evapotranspiracin (Accessed: May 27, 2018)

[9] Agromet Red Agroclimática Nacional. Available from: http://agromet.inia.cl/ Accessed: July 1, 2017

[10] Gonzalez-Andujar JL et al. SIMCE: An expert system for seedling weed identification in cereals. Computers and Electronics in Agriculture. 2006;**54**(2): 115-123

[11] Andri P, Siti MW, Azhari. Expert system model for identification pests and diseases of Forest tree plantations. International Journal of Advance Soft Computing and its Applications. 2017; **9**(2):204-216

[12] Evangelos A et al. Integrating RFIDs and smart objects into unified internet of things architecture. Advances in Internet of Things. 2011;**1**:8

[13] Chen XY, Zhi-Gang J. Research on key technology and applications for the internet of things. Physics Procedia. 2011;**33**:561-566

[14] Rubeena MM, Denny J, Gokilavani M. Recent survey on IOT application: Smart agriculture. International Journal of Innovative Research in Advanced Engineering. 2019;**6**: MYAE10081. DOI: 10.26562/IJIRAE. 2019.MYAE10081

[15] Anand N, Er VP. Smart farming: IOT based smart sensors agriculture stick for live temperature and moisture monitoring using Arduino, Cloud Computing & Solar Technology.

International Journal of Engineering Research & Technology. 2016

[16] Maras V, Popovic T, Gajinov S, Mugosa M. Optimal irrigation as a tool of precision agriculture. In: 2019 8th Mediterranean Conference on Embedded Computing (MECO): IJERT. 2019. pp. 1-4

[17] Algeeb A, Albagul A, Asseni A, Khalifa O, Jomah OS. Design and fabrication of an intelligent irrigation control system. Latest Trends on Systems.

[18] Balakrishna K, Rao M, Kumar YHS. A WSN application to optimize the irrigation for horticulture crops in real-time using climatic parameters. Journal of Advance Research in Dynamical and Control Systems. 2018; **10**:199-207

[19] Baoanh TN, Tan S-L. Real-time operating Systems for Small Microcontrollers. IEEE Micro. 2009;**29**: 30-45

[20] Arumugam SS, Ganeshmurthi M, Annadurai R, Ravichandran V. Internet of things based smart agriculture. International Journal of Advnaces in Computer and Electronics Engineering. 2018;**33**:8-17

[21] Boonchieng E, Chieochan O, Saokaew A. Smart farm: Applying the use of node MCU, IOT, NETPIE and LINE API for a lingzhi mushroom farm in Thailand. IEICE Transactions on Communications. 2018;**101**:16-23

[22] Talpur MSH, Shaikh MH, Talpur HS, et al. Relevance of internet of things in animal stocks chain Management in Pakistan's perspectives. International Journal of Information and Education Technology. 2012;**2**(1):29-32

[23] Rawal S. IoT based smart irrigation system. International Journal of Computers and Applications. 2017; **159**:7-11

[24] Guo T, Zhong W. Design and implementation of the span greenhouse agriculture internet of things system. In: Proceedings of the 2015 International Conference on Fluid Power and Mechatronics, Harbin, China. Research Gate; 5–7 August 2015

[25] Khattab A, Abdelgawad A, Yelmarthi K. Design and implementation of a cloud-based IoT scheme for precision agriculture. In: Proceedings of the 28th International Conference on Microelectronics, Giza, Egypt. Research Gate; 17–20 December 2016

[26] Nawandar NK, Satpute VR. IoT based low cost and intelligent module for smart irrigation system. Computers and Electronics in Agriculture. 2019;**162**: 979-990

[27] Barkunan SR, Bhanumathi V, Sethuram J. Smart sensor for automatic drip irrigation system for paddy cultivation. Computers and Electrical Engineering. 2019;**73**:180-193

[28] Parameswaram G, Sivaprasath K. Arduino based smart drip irrigation system using internet of things. International Journal of Engineering and Computer Science. 2016;**6**:5518-5521

[29] Kumar A, Surendra A, Mohan H, Valliappan KM, Kirthika N. Internet of things based smart irrigation using regression algorithm. In: Proceedings of the 2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Kannur, India. IJESC; 6–7 July 2017

[30] Kodali RK, Jain V, Karagwal S. IoT based smart greenhouse. In: Proceedings

of the 2016 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Agra, India. IEEE; 21–23 December 2016

[31] Abidin SAHZ, Inrahim SN. Web-based monitoring of an automated fertigation system: An IoT application. In: 2015 Proceedings of the IEEE 12th Malaysia International Conference on Communications, Kuching, Malaysia. 23–25 November, 2015. pp. 1-5

[32] García L, Parra L, Jimenez JM, Lloret J, Lorenz P. IoT-based smart irrigation systems: An overview on the recent trends on sensors and IoT Systems for Irrigation in precision agriculture. Surveys of Sensor Networks and Sensor Systems Deployments Sensors. 2020;**20** (4):1042. DOI: 10.3390/s20041042

[33] Babu MSP, Murty NVR, Narayana SVNL. A web-based tomato crop expert information system based on artificial intelligence and machine learning algorithms. International Journal of Computer Science and Information Technologies. 2010;**1**(1):6-15

[34] Daskalakis SN, Goussetis G, Assimonis SD, Tenzeris MM, Georgiadis A. A uW backscatter-morse_leaf sensor for low-power agricultural wireless sensor networks. IEEE Sensors Journal. 2018;**18**:7889-7898

[35] Jain S, Vani KS. A survey of the automated irrigation systems and the proposal to make the irrigation system intelligent. International Journal of Computational Science and Engineering. 2018;**6**:357-360

[36] Karimi H, Navid H, Besharati B, Behfar H, Eskandari I. A practical approach to the comparative design of non-contact sensing techniques for seed sow rate detection. Computers and Electronics in Agriculture. 2017;**142**:165-172

[37] Mohanraj I, Ashokumar K, Naren J. Field monitoring and automation using IOT in agriculture domain. In: 6th International Conference on Advances in Computing & Communications, ICACC 2016, 6–8 September 2016. Vol. 93. Cochin, India: Procedia Computer Science; 2016. pp. 931-939

[38] Mizunuma M, Katoh T, Hata SI. Applying IT to farm fields a wireless LAN. Special Feature. 2003;**1**:56-60

[39] Balakrishna K. Fusion approach-based horticulture plant diseases identification using image processing. In: Chakraborty S, Mali K, editors. Applications of Advanced Machine Intelligence in Computer Vision and Object Recognition: Emerging Research and Opportunities. Hershey, PA: IGI Global; 2020. pp. 119-132

[40] Balakrishna K, Rao M. Tomato plant leaves disease classification using KNN and PNN. International Journal of Computer Vision and Image Processing (IJCVIP). 2019;**9**(1):51-63

[41] Balakrishna K. WSN-based information dissemination for optimizing irrigation through prescriptive farming. International Journal of Agricultural and Environmental Information Systems (IJAEIS). 2020;**11**(3):14

[42] Zampieri M, Carmona García G, Dentener F, Krishna Gumma M, Salamon P, Seguini L, et al. Surface freshwater limitation explains worst rice production anomaly in India in 2002. Remote Sensing. 2018;**10**:244

[43] González-Briones A, Castellanos-Garzón JA, Mezquita Martín Y, Prieto J, Corchado JM. A framework for knowledge discovery from wireless sensor networks in rural environments: A crop irrigation systems case study.

Wireless Communications and Mobile Computing. 2018;**2018**:6089280

[44] Sebastian S, Ray PP. Development of IoT invasive architecture for complying with health of home. In: Proceedings of the International Conference on Computing and Communication Systems (I3CS), Shillong, India. Wireless Communications and Mobile Computing; 9–10 April 2015

[45] Ferrández-Pastor FJ, García-Chamizo JM, Nieto-Hidalgo M, Mora-Pascual J, Mora-Martínez J. Developing ubiquitous sensor network platformusing internet of things: Application in precision agriculture. Sensors. 2016;**16**:16-1141

[46] Merezeanu D, Vasilescu G, Dobrescu R. Context-aware control platform for sensor network integration in IoT and cloud. Studies in Information and Control. 2016;**25**:489-498

[47] Robles T, Alcarria R, Martín D, Morales A, Navarro M, Calero R, et al. An internet of things-based model for smart water management. In: Proceedings of the 28th International Conference on Advanced Information Networking and Applications Workshops, Victoria, BC, Canada. 13–16 May 2014

[48] Ayaz M, Ammad-Uddin M, Sharif Mansour Z, Aggoune E-HM. Internet-of-things (IoT)-based smart agriculture: Toward making the fields talk, special section on new technologies for smart farming 4.0 research challenges and opportunities. IEEE Access. 2019;**7**: 129551-129583

2022 International Conference for Advancement in Technology (ICONAT)
Goa, India. Jan 21-22, 2022

Extraction of 5 Parameters of Single Diode Model with and without Optimisation Method Along With I-V And P-V Characteristics Behavior

Supriya Ramachandra Patil
Research Scholar,
Department of Electrical & Electronics Engineering
Sandip University,
Nashik, Maharashtra, India..
Supriyathakur78@gmail.com

Dr. Rahul Agrawal
Associate Professor,
Department of Electrical & Electronics Engineering,
Sandip University,
Nashik. Maharashtra. India.

***Abstract*—The whole globe is moving toward open, widely utilized, and easily maintained renewable energy sources. When we compare the greatest energy sources, models, and methodologies, we find that sun-fueled energy is the best. Because daylight-based energy may be employed, we'll need to switch to a technology that converts sunlight into electrical energy, such as photovoltaic (PV) cells or modules. This concept use mathematical exhibiting and a nearly similar circuit to understand known and unknown limitations. Conclusion This is the critical examination that focuses on the constraint of the PV cell or the module. In this paper, we worked on comparative methodologies which are used to extract the unknown parameters by using known manufacturing data of various PV cells or the modules such as photocurrent (Iph), diode saturation current (Is), diode ideality factor (A), series resistance (Rs), shunt resistance (Rush). Along with all of this procedure, we also study about differentiae behavior of PV models that is Current-Voltage, Power-Voltage features as far as differentiae manners.**

Keywords— Photovoltaic modules and cells, single-diode model, parameter extraction , mathematical modelling.

I. INTRODUCTION

As we find out with regards to the PV cell or the PV module that should be changed over into unequivocal model and that model have used for different savvy similarly as the improvement procedure. Different researcher and analyst wrapped up or noticed quick similarly as the improvement results by differentiating and different modules in like manner with reference of gathering information. In this paper not really settled and broke down five boundaries limits for single diode model using logical similarly as progression techniques. There are different systems to process five obscure boundaries of different diode models, for instance,

Scientific Method: This strategy uses the I-V attributes data to extricate boundaries. However, rule drawback of this methods are they habitually incorporate approximations and can be in exact or produce conditions that are difficult to settle.

Boundary assessment and Optimization: Another way of managing choose the model limits which incorporates boundary extraction and improvement. It is moreover called as the metaheuristic strategy since it endeavours to find the model boundary extraction fundamentally (for instance heuristically or iteratively) by applying some understanding and headway.

Combination of logical (Analytical) and metaheuristic methodologies: As the name derives it is the blend of astute and the assessment and Optimization strategy. This procedure has the power of straightforwardness and the down to earth showing approach.[1][2][6][7][8][9].

II. BASIC OPERATION OF PV CELL

A. Photovoltaic Cell:

- Photovoltaic cells are composed of two layers of transistors, one with positive charge and another with negatively charged, lined up against each other.
- Sunlight, which includes tiny sparklers known as photons, hits the cell and is reflected, transferred, or stored.
- When photons are eaten by the photoelectric cell's forms of pollution, their energy is transferred to an electron in a section of the cell.
- The electron travels from the molecule's outer shell as the energy increases. The released electron usually migrates towards the positive layer, establishing a clear distinction between both the favorable and unfavorable layers. The electron passes across the circuit, creating a current, whenever the two pieces are exposed to an electrical circuit. [23].

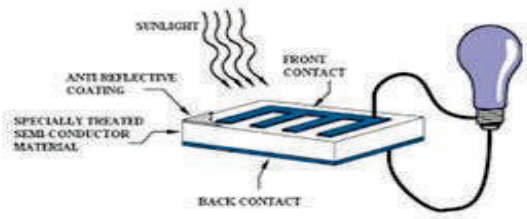


Fig. 1. Basic operation of PV Cell

B. Characteristics conduct of PV Cell.

Sun-based Cell I-V Characteristic Curves, like P-V attributes, illustrate the current and voltage (I-V), force and voltage (P-V) characteristics of a given photovoltaic (PV) cell, module, or cluster, providing a clear picture of its sun-based energy transformation capability and productivity. Considering the electromagnetic I-V attributes (especially Pmax) of a daylight cell or circuit is critical in determining the device's yield performance and light efficiency.

2022 International Conference for Advancement in Technology (ICONAT) | 978-1-6654-2577-3/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICONAT53423.2022.9726046

Figure 2 portrayed every important boundary and construction of specific attributes which used to gauge and streamlined boundary for any diode model for PV cell, module or exhibit [2][3][7][23]

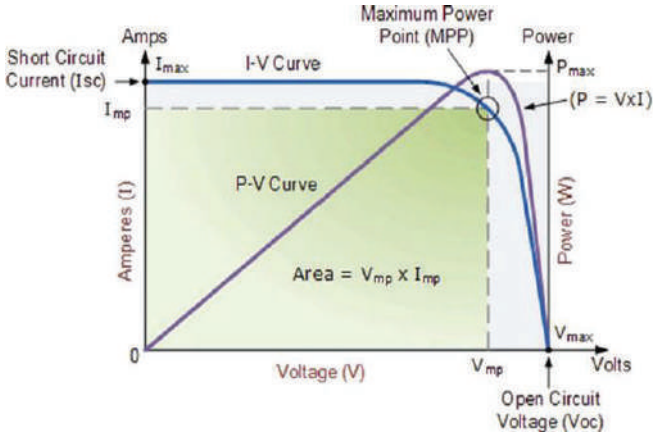


Fig. 2. Overall characteristics of PV Cell

III. PHOTOVOLTAIC MODELLING AND PROBLEM FORMULATION

We have covered the basic idea for diode modelling and analyzing and optimizing methods, but we still need to go through the specifics in the form of mathematical calculations for a single diode PV cell design. [15] [16][17].

A. Utilizing The single diode model, create a non-ideal circuit model for PV cells:

The series resistance and the resistance in series (Rs and RSh) are mentioned in non-ideal circuit models (parallel or the shunt resistance). It has to do with the PV cell's light-generating source. Figure 3 depicts the relationships. This form of the model is known as the five-parameter model, and it includes parameters such as. [1][5][6] [7].

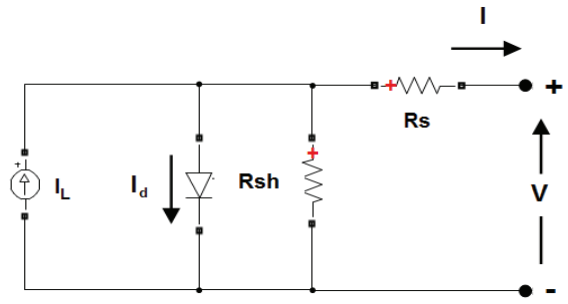


Fig. 3. Practical Single diode model for PV cell.

A = The diode Ideality factor

Id= Specific diode current

I_L = Light generation by the current source

Rsh = Impedance that is parallel

Rs = The series resistance.

This model has a better series performance and a lower series resistor. The constants load impedance and equivalent connection are particularly significant in this model. [1][2][6][7]. We have a differential formula for a single diode model that is realistic, such as:

$$I = I_L - I_d - I_{sh} \tag{1}$$

Id (diode current) may be calculated from the following equation.

$$I_d = I_O(\exp(\frac{V + IR_s}{n_s V_T}) - 1 \tag{2}$$

$$I = I_L - I_O(\exp(\frac{V + IR_s}{n_s V_T}) - 1) - \frac{V + IR_s}{R_{sh}} \tag{3}$$

As a result, the single diode system contains five unknown values: [Io, A, Rsh, Rs, IL]. [1] [2] [7] [8].

IV. ANALYTICAL EVALUATION WITH SINGLE DIODE MODEL

This study aids in the numerical demonstration and planning of the PV module using logical as well as evolution-based development techniques. The moment at which we combine both the task and the way we think about information is referred to as a mixing kind of method. To determine each of the five parameters, we must first identify each of the specific criteria that may be used to calculate something comparable using numerical conditions in the MATLAB programming tool [13]. Along with its convenience and precision, the single diode model is utilized for parameter computation and comprehension of PV module conduction. The following criteria are used to dissect and improve or extract five model parameters. Figure 4 shows how a diode model might create a situation by considering each and every important steady and combining facts [15]. [16] [17][18]

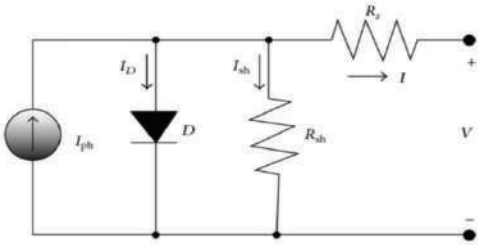


Fig. 4. Schematic mathematical model for single diode

A. Circuit model of Single diode for PV Cell

Figure 4 shows the analogous network of a circuit model, wherein the interfacial diode is coupled simultaneously to the current waveform Iph, as well as the shunt resistance (Rsh) and series resistor (Rs). With these information, we may formulate the calculation:

$$I = I_{ph} + I_o - I_o \exp\frac{q(V + IR_s)}{AN_s kT} - \frac{V}{R_{sh}} - \frac{IR_s}{R_{sh}} \tag{4}$$

The open circuit scenario, short circuit circumstance, and voltage level may all be used to evaluate it.

When I= Isc and V= 0 is used in expression (8), that short circuit situation may be rewritten as I= Isc having zero voltage,

$$I_{sc} = I_{ph} + I_o - I_o \exp(\frac{I_{sc}R_s}{AN_s V_t}) - \frac{I_{sc}R_s}{R_{sh}} \tag{5}$$

$$V_t = \frac{kT}{q} = 0.256796 \tag{6}$$

Thermal voltage of the module at open circuit voltage I = 0 and V=Voc rewrite the equation (5)

$$I_{ph} = I_o(\frac{V_{oc}}{AN_sV_t}) - I_o + \frac{V_{oc}}{R_{sh}} \tag{.(7)}$$

For fast and accurate convergence above equation converted into the logarithmic

$$\ln(I_{ph} + I_o - \frac{V_{oc}}{R_{sh}}) - \ln(I_o) = \frac{V_{oc}}{AN_sV_t} \tag{8}$$

Using equation (5) we can also find the maximum power point condition

$$I = I_{mpp}\ V = V_{mpp}$$

$$I_{mpp} = I_{ph} + I_o - I_o \exp(\frac{V_{mpp} + I_{mpp}R_s}{AN_sV_t}) - \frac{V_{mpp} + I_{mpp}R_s}{R_{sh}} \tag{9}$$

It can be rearranged as

$$\ln(I_{ph} + I_o - I_{mpp} - \frac{V_{mpp} + I_{mpp}R_s}{R_{sh}} - \ln(I_o) = \frac{V_{mpp} + I_{mpp}R_s}{AN_sV_t} \tag{10}$$

Subtracting equation (8) and (10) we have

$$\ln(\frac{I_{ph} + I_o - \frac{V_{oc}}{R_{sh}}}{I_{ph} + I_o - I_{mpp} - (\frac{V_{mpp} + I_{mpp}R_s}{R_{sh}})}) = \frac{V_{oc} - V_{mpp} - I_{mpp}R_s}{AN_sV_t} \tag{11}$$

This equations, expressed as, was used to decrease computational models of five variables

$$A = \frac{V_{oc} - V_{mpp} - I_{mpp}R_s}{N_sV_t[\ln(I_{ph} + I_o - V_{oc}/R_{sh}\ /I_{ph} + I_o - I_{mpp} - (\frac{V_{mpp} + I_{mpp}R_s}{R_{sh}})]} \tag{12}$$

We understand that there have been five factors in the circuit model for PV cell that are undetermined. So we need to determine the remainder of the characteristics that were generated using the manufactured information sheet, and then we need to analyses the characteristics using this example. [1] [12] [14] [17] [18] [19] [20]

1) Analysis of photocurrent (Iph)

The most significant cause is photocurrent, which is also known as light produced electricity by the PV cell. To estimate this component, restructure the formula as follows:

$$I_{ph} = I_{sc} - I_o + I_o \exp(\frac{I_{sc}R_s}{AN_sV_t}) + \frac{I_{sc}R_s}{R_{sh}} \tag{13}$$

This expression, on the other hand, has a significant link with temperatures, irradiation, and the ambient temperature of fault current present K1, which may be expressed as Ki.

$$I_{ph} = \frac{S}{S_{STC}}[I_{phSTC} + K_1(T - T_{STC}) \tag{14}$$

In above calculation

T= Definite temperature in the kelvin

T_{STC}= The temperatures of the test conditions is of 298.15 K

S= It's the amount of light that reaches the PV cell's surface.

S_{STC} = It is irradiance at STC typically 1000W/m2

Iphstc=It is the light produced ordinary current at STC according to [1][14][12].

2) Factor Analysis for Diode ideality

The ideality factor of a diode is determined under conventional test conditions using data from the production data sheet. As a report sheet, a standardized variable is supplied that may be used to calculate the diode overstrength factor. Isc, Impp, Voc, and Vmpp data have been supplied. The diode ideality factor is calculated using equation (12) with short circuit current conditions of Rs=0 and Rsh =∞

$$A = \frac{V_{oc} - V_{mpp}}{N_sV}[\ln(\frac{I_{sc} + I_0}{I_{sc} + I_0 - I_{mpp}})]^{-1} \tag{15}$$

[1][12][14][17][19][20]

3) 4.1.3 Analysis of saturation current

Saturated current at open circuit voltage as well as short circuit circumstance may be determined using equations (4), (5), and (6).

$$[I_0]_{I_{sc}V_{oc}} = \frac{I_{sc}R_{sh} + I_{sc}R_s - V_{oc}}{R_{sh}[\exp(\frac{V_{oc}}{AN_sV_t}) - \exp(\frac{I_{sc}R_s}{AN_sV})} \tag{16}$$

With the help of the calculation, saturated current may be treated as a constant STC. Because I0 is temperature dependent, we may compute the best value by taking into account terms like impedance and series resistor, such as Rs=0 as well as Rsh = ∞ [1][14][12].

4) Analysis of series resistance and shunt resistance

We distinguish that while calculating the ideal value, series and load resistor will be ignored. Even though in the elimination of series and parallel resistance, the ideal combination of solar module characteristics was estimated at the greatest power point. However, we may investigate and evaluate the solution under a variety of conditions. Only use the maximum power output:

By rearrange the equation (9) we can write as

$$R_{sh} = \frac{V_{mpp} + \mathrm{I}_{mpp}R_s}{I_{ph} - I_{mpp} - I_o(\exp((\frac{V_{mpp} + \mathrm{I}_{mpp}R_s}{AN_sV_t})) - 1)} \tag{17}$$

In the presence of an internal resistance and a voltage level. Equating (7) and (8) and comparing and correlating the equations with Rsh and Rs, as well as the conditions specified, we get using,

$$R_{sh} = \frac{V_{oc} - I_{sc}R_s}{I_{sc} + I_0\exp(\frac{I_{sc}R_s}{AN_sV_t}) - I_o\exp(\frac{\exp V_{oc}}{AN_sV_t})}$$

(18).[1][12][14][17][18][19][20]

Therefore, we can examine these five characteristics using different algebraic equation and apply them to numerous solar modules while incorporating production data

sheets to achieve diverse findings using the MATLAB software application. All of this labor came to a close with a process flow.

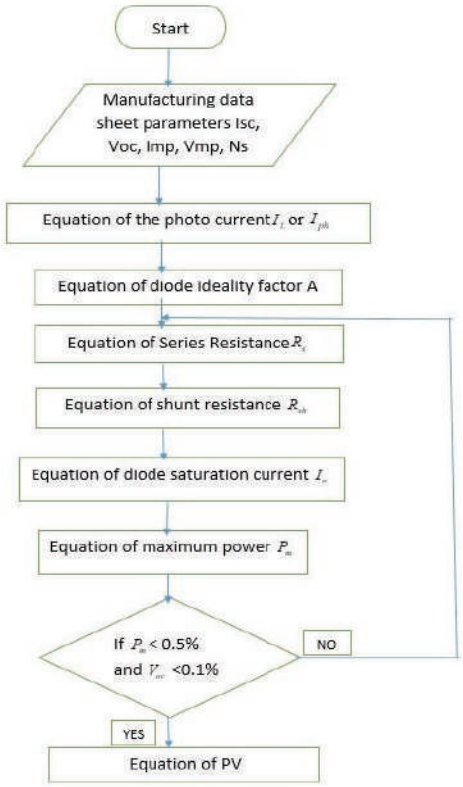


Fig. 5. : Analytical approach flow chart for calculating five parameters

V. PSO APPRAOCH FOR EVALUATION OF FIVE PARAMS TO SINGLE DIODE MODEL OF PV CELL

This is the most effective optimization approach, which was created by Kennedy and Ebehart in 1995. It is a self-organized approach that is used to optimize predictable and unpredictable parameters in many applications such as electrical systems, control systems, and renewable energy optimization. This strategy is capable of obtaining greater levels of intellect. PSO employs a simple and social modeling approach that may be used to addressing optimization challenges. To determine optimum settings, we utilize the MATLAB programme. Another benefit of the PSO is that it is a community optimization approach with a powerful and efficient algorithm. They establish a swarm of electrons, which are the characteristics of any form of model on and that we have to work, and the location of each component indicated by the PSO method.

d- problem space in the dimensional vector

Represented by (Si) according to [18] and [20].

$$S_i = S_{i1}, S_{i2} \ldots\ldots\ldots\ldots\ldots S_{id}$$

In below equation

d = vector for dimensional

$i = 1, 2, \ldots\ldots M$ M= population size

The PSO performance is based on a preset optimization process. Every particle in d=dimensional space serves as a PSO membership function.

In PSO, the speed of the ith particle is associated with a $V_i = V_{i1}, V_{i2}, \ldots\ldots\ldots\ldots\ldots V_{id}$ change in component location when compared to the model parameters. The PSO method was employed to successfully execute optimization strategies, and the global best value work was done for it. Every particle in the optimized system adapts to its prior optimal location, notably Pi and Pg, in this process, which is followed by iterations informed by the following equations.

$$V_i(t+1) = V_i(t) + C_1 rand_1 (P_i - S_i(t)) + C_2 rand_2 \quad \ldots (19)$$

$$S_i(t+1) = S_i(t) + V_i(t+1) \quad \ldots\ldots\ldots\ldots\ldots (20)$$

Pi = Pi1, Pi2,…… PiNis the best position by ith particle

Pg represents the best position found by any member in the whole swarm populating

T= iteration counter,

C1and C2= acceleration coefficients,

rand1and rand2= two uniform random numbers in [0,1]

When we compared this approach to the optimised or calculated initial values of the single diode model, including such [Iph, Io, A, Rsh, Rs], we can see that the theoretical formalism for the same is encoded into binary representation and is known as genomes. Set or contemplate the length of the strings, as well as the model demand and calculating component for the same. All of the findings were calculated using the MATLAB 2020a Graphical interface with the help of several production specifications [14][18][19][21][22]

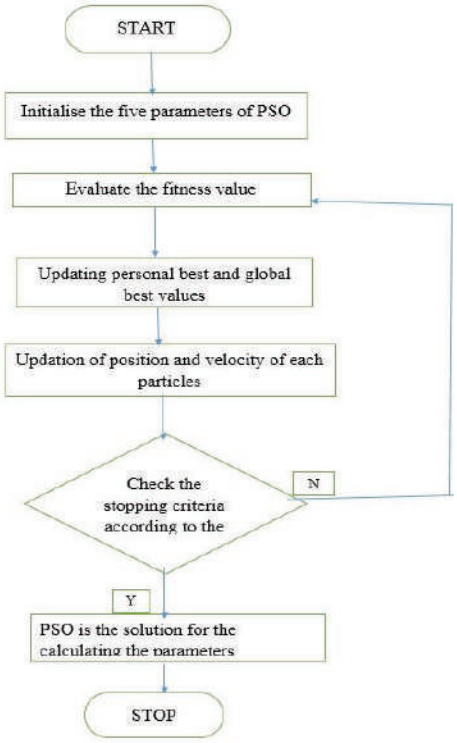


Fig. 6. : Illustrates the steps for the PSO technique of calculating the PV cell's five parameters. [17]

VI. RESULTS AND DISCUSSION:

The identification of five variables, as well as quantitative and optimization methods, have been done in

this article. The MATLAB software tool was used to assist this implementation, which used theoretical single diode quantitative formulas to operate on the numerous module data sheets provided in table 1. Different PV modules with varying numbers of cells linked in series were utilized to evaluate both analytical and optimization approaches. Table 1 shows how independent variables for a single diode type are estimated using known data provided by the manufacturer beneath typical test conditions.

TABLE I. MODULE FOR ANALYZING DIODE UNKNOWN PARAMETER MANUFACTURING DATA IN ACCORDANCE WITH THE REQUIREMENTS

PV Module\Parameters	MSX60	KL070	BP-MSX120	BP-SX150	KC 200GT
I_{sc} (A)	3.8	4.59	3.87	4.75	8.21
I_{mpp} (A)	3.5	4.1	3.56	4.35	7.61
V_{oc} (V)	21.1	21.5	42.1	43.5	32.9
V_{mpp} (V)	17.1	17.1	33.7	34.5	26.3
N_s	36	36	72	72	54

The derivation of five variables of the circuit model from production data sheets given in table 1 well-known spreadsheets functioned under standard conditions, so the analytically and optimization methods were evaluated. These known characteristics are contrasted to the suggested approach in table 2, table 3, and table 4 to examine unknown values.

TABLE II. RESULTS OF VARIOUS MODULES WITH EVALUATING ANALYTICAL AND PSO OPTIMIZATION.

PV Modules\ Parameters	MSX60		KL070	
Estimated Parameters	Analytical Method	PSO Method	Analytical Method	PSO Method
I_{ph}	3.807	3.805	4.612	4.602
I_o	3.62E-09	1.26E-08	2.80E-09	1.09E-07
A	1.1	1.17	1.1	1.327
R_{sh} (ohm)	133	200	48.96	100
R_s (ohm)	0.2563	0.2705	0.2373	0.2635

With values of unknown parameters determined by analytical and PSO methods with all various modulesMSX60,KL070,BP-MSX120,BP-SX150,KC200GT throughout the extraction process, as described in tables 3, 4, and 5. All measurement varied for the single diode model were calculated using the analytical method, including photo current Iph (3.807, 4.612, 3.88,4.767,8.227,), diode saturation current Io(3.62E-09, 2.80E-09, 3.87E-09, 2.36E-09, 3.49E-09,), and diode ideality factor (with seeming ideal values range from 1 to 2(1,1.1,2)),

TABLE III. RESULTS OF NUMAROUS APPRAOCHES WITH EVALUATING ANALYTICAL AND PSO OPTIMIZATION.

PV Modules\ Parameters	BP-MSX120		BP-SX150	
Estimated Parameters	Analytical Method	PSO Method	Analytical Method	PSO Method
I_{ph}	3.88	3.883	4.767	4.765
I_o	3.87E-09	1.34E-08	2.36E-09	1.50E-08
A	1.1	1.171	1.1	1.203
R_{sh} (ohm)	252.1	200	167.5	200
R_s (ohm)	0.623	0.6515	0.6029	0.634

TABLE IV. EVALUATION OF VARIOUS MODULES WITH COMPARING ANALYTICALAND PSO OPTIMIZATION

PV Modules\ Parameters	KC200GT	
Estimated Parameters	Analytical Method	PSO Method
I_{ph}	8.227	8.222
I_o	3.49E-09	8.08E-09
A	1.1	1.144
R_{sh} (ohm)	124.6	184.1
R_s (ohm)	0.2627	0.2693

The series resistance Rs is the most critical characteristic that affects short circuit current and open circuit voltage (0.2563, 0.2373, 0.623, 0.6029,0.2627) Due to the condition of Rs=0, this resistance is usually ignored. Shunt resistance parameter determined using analytical technique for various modules Rsh (133, 48.96, 252.1, 167.5, 124.6,) in this manner estimate the parameter using analytical values and compare with optimization technique PSO.

Shunt resistance Rsh (200,100,200,200,184.1)

Along with all of these methods, we investigated the current-voltage and power-voltage characteristics of PV models in the MATLAB 2020a version, taking into account the GUI interface. It is provided below. Module MSX60, KL070, BP-MSX120, BP-SX150, Module KC200GT, Module KC Such modules address both analytical and PSO methods, taking into account voltage-current and voltage-power characteristics, as well as the influence of calculated parameters on the very same.

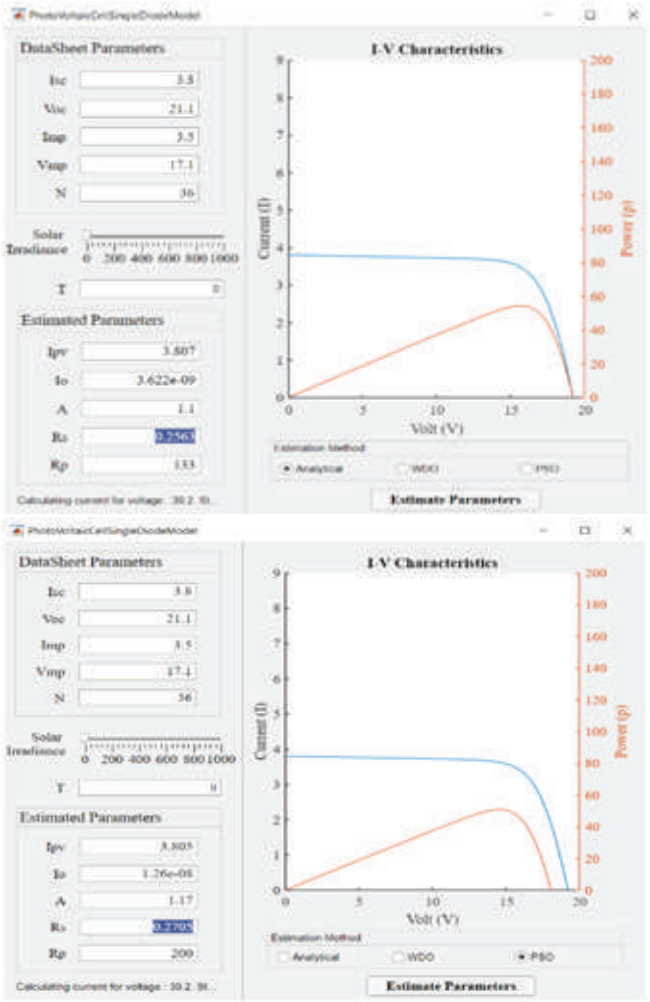
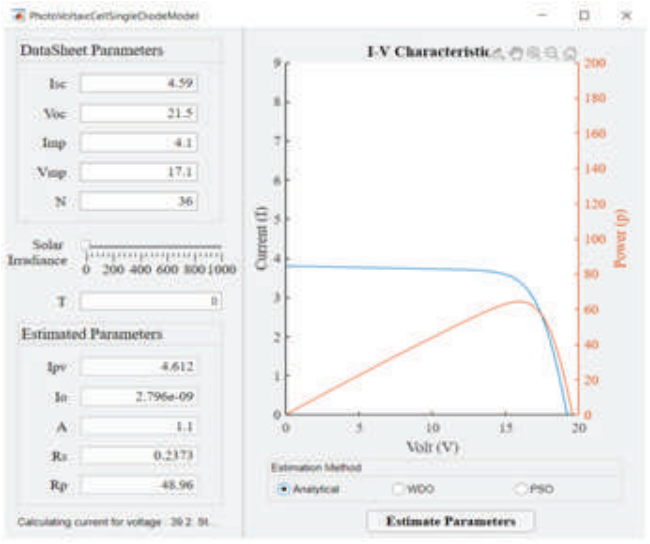


Fig. 7. Features behaviour of ModuleMSX60 (Analytical and PSO)



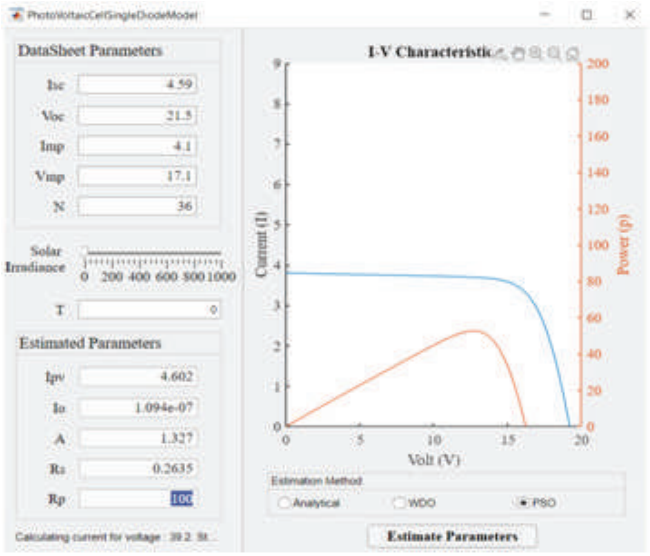
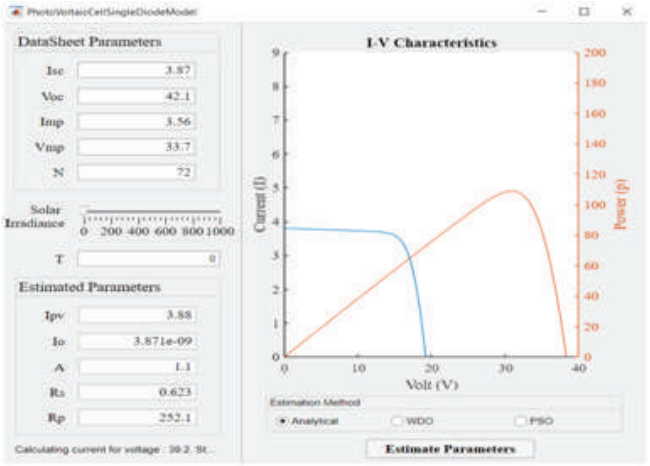


Fig. 8. Characteristics behaviour of Module KL070 (Analytical and PSO)



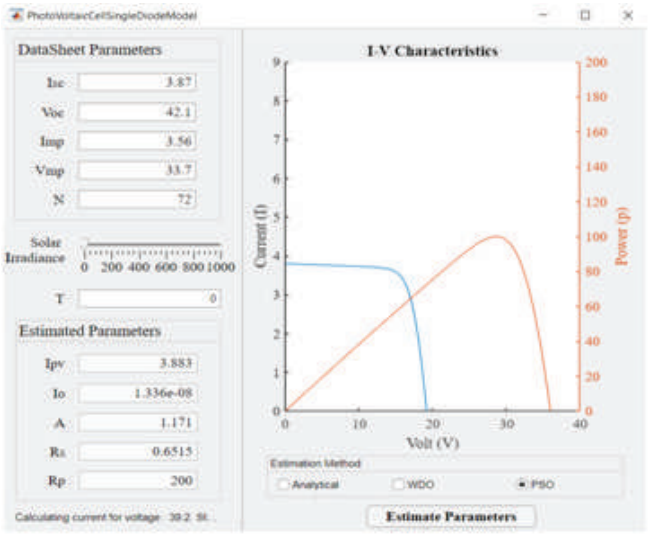


Fig. 9. Appearances behaviour of Module BP-MSX120 (Analytical and PSO)

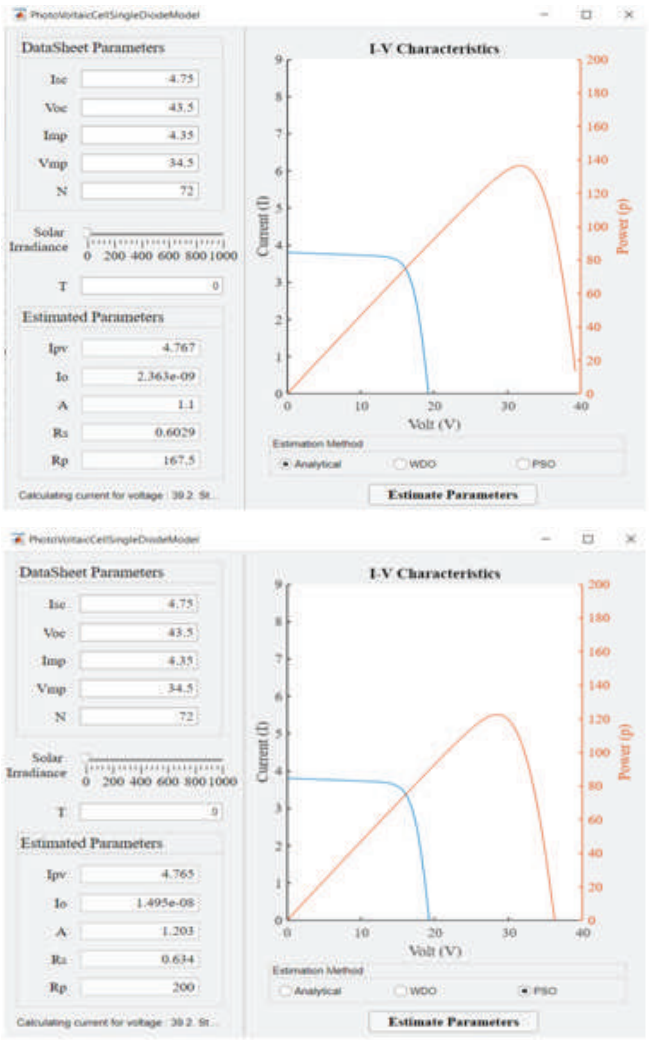
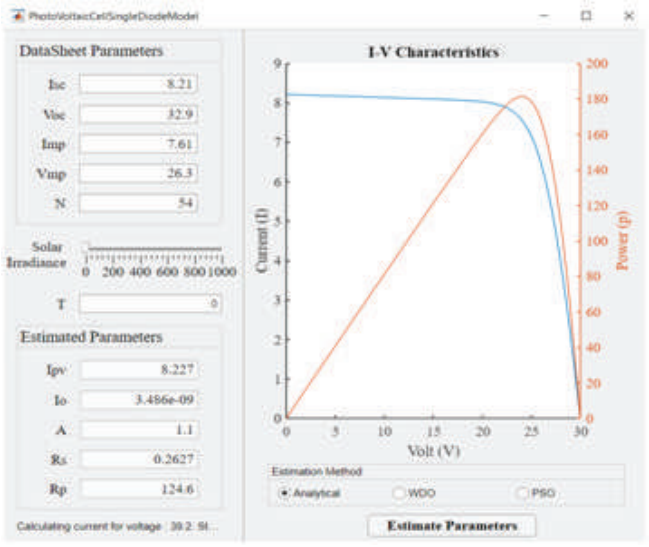


Fig. 10. Characteristics behaviour of Module BP-SX150 (Analytical and PSO)



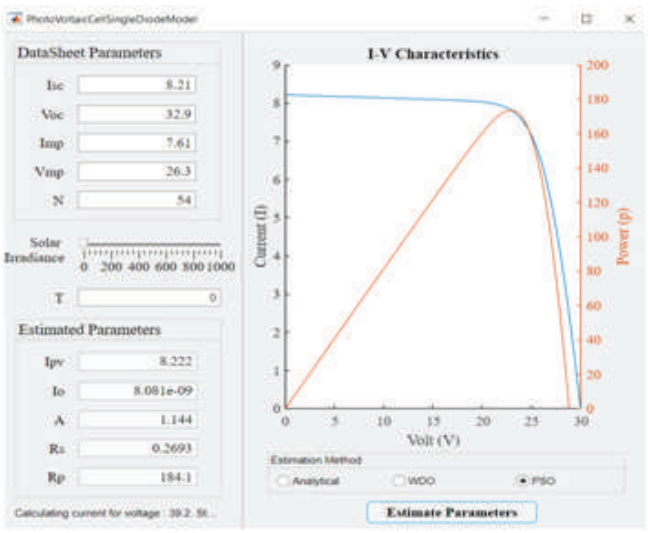


Fig. 11. Features behaviour of Module KC200GT (Analytical and PSO)

VII. Conclusion:

In this manner both such as optimization and without optimization strategy applied on various modules (for results discussion consider different five modules shown in table 1) and decide the obscure boundaries of a Single diode model. These all-outcomes dependent on the known manufacturing information sheet esteems which gives various outcomes along looking at other technique moreover. This technique distinguished by numerical conditions and required accurate information sheet boundaries whose gave us ideal just as insightful qualities. This results likewise utilized for the specific module determination with precise and accurate assessed values. Alongside all thought required information additionally applied for the environmental condition like irradiance and the temperature. All results and discussion done in results section along with Table 3, table 4, table 5.These all experimental details are applicable for before the installation of different modules considering by applications. It is used to determine known as well as unknown parameters for the different diode model such as Single diode, double diode, triple diode which will be proposed future experimental consideration.

References

[1] R. Robinson Ndegwa, “A Fast and Accurate Analytical Method for Parameter,” Journal of Renewable Energy, vol. 2020, pp. 1-18, 15 May 2020.

[2] V. Stornelli, “A New Simplified Five-Parameter Estimation Method,” Energies, vol. 12, pp. 1-20, 2019.

[3] K. Yua, “A performance-guided JAYA algorithm for parameters identification of,” Applied Energy , vol. Volume 237, pp. 241-257, 1 March 2019.

[4] B. Yang, “Comprehensive Overview of Meta-heuristic Algorithm Applications,” Energy Conversion and Management, vol. 208, no. 112595, pp. 1-38, 2020.

[5] M. Calasan, “Estimation of Single-Diode and Two-Diode Solar Cell,” Energies, vol. 12, no. 21, pp. 1-14, 4 November 2019.

[6] H. Bellia, “A detailed modeling of photovoltaic module,” National Research Institute of Astronomy and Geophysics, vol. 3, no. 1, pp. 53-61, 16 May 2014.

[7] S. Apatekar, “Mathematical Modeling of Photovoltaic Cell,” International Journal of Science and Research (IJSR), vol. 4, no. 4, pp. 2950-2953, April 2015.

[8] M. J. •. F. M.-B. •. M. Bigdeli1, “Very accurate parameter estimation of single- and double-diode,” Int J Energy Environ Eng, vol. 7, pp. 13-25, 2016.

[9] A. R. J. 1, “Parameter estimation of solar photovoltaic (PV) cells: A review,” Renewable and Sustainable Energy Reviews, vol. 61, pp. 354-371, August 2016.

[10] Z. S. Haitao Wu , “Research on Parameter Extraction Method of Photovoltaic,” International Journal of Photoenergy, vol. 2020, pp. 1-12, 13 January 2020.

[11] C. G. H. Hussein Mohammed Ridha, “Estimation of photovoltaic module model’s parameters using,” Neural Computing and Applications, vol. 32, pp. 12627-12642, January 2020.

[12] D. Revati, “I-V and P-V characteristics analysis of a photovoltaic module by different,” Materials Today:Proceeding, vol. 33, no. Part1, pp. 261-269, 2020.

[13] L. M. P. Deotti, “Parameter extraction of photovoltaic models using an enhanced Lévy flight,” Energy Conversion and Management, vol. 221, pp. 1-20, June 2020.

[14] M. Arabshahi, “A method for hybrid extraction of single-diode model parameters of photovoltaics,” Renewable Energy, vol. 158, pp. 236-252, October 2020.

[15] A. K. P, “Adaptive Genetic Algorithm Based Multi-Objective Optimization For Photovoltaic Cell Design Parameter Extraction,” in 1st International Conference on Power Engineering, Computing and CONtrol, PECCON-2017, VIT University, Chennai Campus, 2017.

[16] B. Zina, “Photovoltaic Cell Mathematical Modelling,” International Journal of Engineering Research & Technology (IJERT), vol. 6, no. 6, pp. 884-887, June - 2017.

[17] Haider Ibrahim, “Evaluation of Analytical Methods for Parameter Extraction of PV,” in Energy Procedia, Chania, Crete, Greece, 5-7 July 2017.

[18] A. Harrag, “Three, Five and Seven PV Model Parameter Extraction using PSO,” in Energy Procedia, Beirut Lebanon, 21-24 April 2017.

[19] M. Derick, “An improved optimization technique for estimation of solar photovoltaic,” Solar Energy, vol. 157, pp. 116-124, 15 November 2017.

[20] R. Abbassi, “Identification of unknown parameters of solar cell models: A comprehensive,” Renewable and Sustainable Energy Reviews, vol. 90, pp. 453-474, July 2018.

[21] B. Nayak, “Parameter estimation of single diode PV,” Renewable Energy Focus, vol. 30, pp. 1-12, September 2019.

[22] D. Oliva, “A review on meta-heuristics methods for estimating parameters of,” Journal of Power Sources , vol. 435, pp. 1-15, 30 September 2019.

[23] www.pveducation.org

4th International Conference on Recent Trends in Computer Science and Technology

ICRTCST-2021

11-12 February, 2022 Jamshedpur, Jharkhand, India

PROCEEDINGS

ISBN: 978-1-6654-6633-2

PART: CFP22P42-ART

Organised by

IEEE Kolkata Section

IEEE

IEEE KOLKATA SECTION

2021 4th International Conference on Recent Trends in Computer Science and Technology (ICRTCST) | 978-1-6654-6633-2/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICRTCST54752.2022.9781871

Pre and Post Harvesting using Deep Learning Techniques: A comprehensive study

Conference Paper · February 2022

DOI: 10.1109/ICRTCST54752.2022.9781959

3 authors, including:

Nisha Patil

Guru Gobind Singh College of Engineering & Research Center nashik

10 PUBLICATIONS **6** CITATIONS

SEE PROFILE

Pre and Post Harvesting using Deep Learning Techniques: A comprehensive study

Nisha Deepak Patil[1]
Computer Science and Engineering
Research Scholar
JJT University
Rajasthan, India
npatil21@gmail.com

Dr. Rajesh Kumar Tiwari[2]
Computer Science and Engineering
Professor
RVS college of engineering and Technology
Jamshedpur, India
rajeshkrtiwari@yahoo.com

Dr. Ajit Kumar[3]
Computer Science and Engineering
Research Head
JJT University
Rajasthan, India
dr.ajit@jjtu.ac.in

2021 4th International Conference on Recent Trends in Computer Science and Technology (ICRTCST) | 978-1-6654-6633-2/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICRTCST54752.2022.9781959

Abstract-The paper aims to provide a comprehensive view about the use of deep learning Pre-harvest and Post – Harvest management in viticulture. Traditional approach targets manual aid in Pre and Post-harvest Quantitative and Qualitative analysis of post-harvest and pre-harvest management. The traditional approach has its disadvantages like an undue time consuming, Chances of manual errors and Recordkeeping maybe a voluminous task. The observational study which aims to eliminate technical discrepancies by using deep learning ensures benefits like AI-assisted algorithm and image processing ensures accuracy in data reading and analysis, automatic fruit quality monitoring reduces "Farm–to–Table" time provides better marketing quality for grapes and Optimum utilization of supply chains. We'll look at how machine literacy can be used in current vineyard operations and processes to yield industry-applicable quality. The recurrent neural network is a deep knowledge classifier that may be used to make a system that can identify grapes rested on their quality. Deep learning networks like AlexNet, GoogleNet, and VGG16 (Very Deep Convolutional Networks for Large-Scale Picture Recognition) could enhance image segmentation and classification of grape bunches while also resolving approach negligence. The study concludes by demonstrating how deep literacy can be used for pre-and post-harvest operations in the viticulture industry.

Keywords—Machine learning, Convolutional Neural Networks, Viticulture, Computer vision, Image processing, Deep Learning

I. Introduction

Agricultural productivity is a pressing issue. In developing countries, hundreds of millions of people suffer from hunger and poverty because of low productivity in the agricultural sector. In developed countries, agricultural productivity is stagnating. This has been partially due to increases in pests and diseases that destroy crops. More efficient use of water is also a concern, as more regions experience a drought or a lack of freshwater sources. Machine learning could help solve these problems by providing accurate weather forecasting and predictive models for pest management.
Artificial intelligence has been used to improve fields like healthcare, advertising, and athletics. As farmers are looking for ways to improve their crop yields, machine learning can be applied to many of the challenges they face. Machine learning can help identify patterns in weather data that affect crops, predict which crops will do well in certain areas, or even pinpoint how much fertilizer is needed for a particular field. Agricultural tasks play an important role in harvesting. Harvesting is the process when seasonal fruits or crops are collected from the various fields. Harvesting can be pre-harvesting and post-harvesting using machine learning methodologies. Pre-harvesting is the existing technology used for the production of raw materials. Whereas, post-harvesting is the post-agricultural industry that schedules storage, transportation and processing of finalized food products.

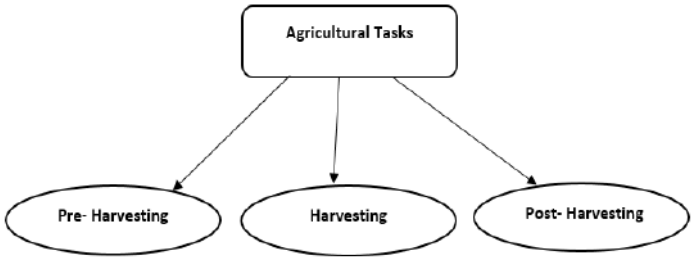


Fig.1 Agricultural tasks

Machine-learning in the agricultural sector is a perfect use case for this technology. It can be used to identify crop pests and bring about a more efficient way of spraying pesticides. Machine learning also plays a big role in the agricultural sector to improve productivity, even with the manipulation of inputs such as fertilizers and seed variety. This article talks about how machine learning can be used in agriculture and how it can make a difference when the aim is to improve productivity. Machine- learning is a field in computer knowledge, which has been playing a more and more important role in the development of artificial intelligence. It includes methods for training algorithms on sample data so that they can later produce accurate predictions or decisions without being explicitly programmed to do so. It can detect patterns in large datasets, which can be helpful when trying to analyze data on climate change.

As machine learning gains scope in various fields, Agriculture has also been left with the exception which is used in fruit identification gives promising results to identify fruit images. This mechanism greatly helps in Pre and Post-

2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)

28-29th April 2022

Department of Electrical & Electronics Engineering

Galgotias College of Engineering and Technology, Greater Noida, India

Organized by:

Technically Co-Sponsored by:

IEEE UP Section

2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) | 978-1-6654-3789-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICACITE53722.2022.9823700

2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)
28-29th April 2022
Department of Electrical & Electronics Engineering
Galgotias College of Engineering and Technology, Greater Noida, India

IEEE Catalog Number: CFP22Y63-ART
ISBN: 978-1-6654-3789-9

Additional copies of this publication are available from

Curran Associates. Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA

+1 845 758 0400
+1 845 758 2633 (FAX)
Email: curran@proceedings.com

2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) | 978-1-6654-3789-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICACITE53722.2022.9823589

Role of Machine Learning in Managing Cloud Computing Security

Conference Paper · April 2022

DOI: 10.1109/ICACITE53722.2022.9823414

6 authors, including:

Nithya Subramanian
Coimbatore Institute of Technology
4 PUBLICATIONS **36** CITATIONS
SEE PROFILE

Apinaya Prethi
Coimbatore Institute of Technology
12 PUBLICATIONS **39** CITATIONS
SEE PROFILE

Melanie Lourens
Durban University of Technology
89 PUBLICATIONS **225** CITATIONS
SEE PROFILE

Nisha Patil
Guru Gobind Singh College of Engineering & Research Center nashik
10 PUBLICATIONS **6** CITATIONS
SEE PROFILE

Role of Machine Learning in Managing Cloud Computing Security

Santosh Kumar
Assistant Professor Computer Science and Engineering Dr. APJ Abdul Kalam Women's Institute of Technology, Darbhanga
jha.santoshkumar@yahoo.co.in

Nithya.S
Assistant Professor, Department of Computer Science and Engineering, Coimbatore Institute of Technology
snithyacit@gmail.com
0000-0001-5253-1469

K.N Apinaya Prethi
Assistant Professor, Department of CSE, CIT
apinayaprethi@cit.edu.in
0000-0003-4292-7966

Suraj Singh
Assistant Professor, Electrical Engineering Department, M. M. Engineering College, M. M. (Deemed to be University), Mullana, (Ambala)
surajsinghynr8@gmail.com

Melanie Lourens
Department of Human Resources Management, Durban University of Technology, South Africa
Melaniel@dut.ac.za

Nisha Patil
Assistant Professor, School of Computer Sciences and Engineering, Sandip University, Nashik
npatil21@gmail.com
0000-0002-0071-077X

2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) | 978-1-6654-3789-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICACITE53722.2022.9823414

***Abstract*- Cloud computing is one of the most trending technology through which digitalized data management and storing becomes easier and more effective. However, besides the advancement of technology, data protection is another top priority concerning factor as millions of sensitive data are gets stored and transferred through the cloud computing system. As per the current days of cyber-activities, data security threat in cloud computing have increased, which posses threat in the development of the business. In that field, machine learning based advanced algorithm develop the virtual encrypted environment to protect the data from unauthorized access and hacking.**

Keywords: Cloud computing, Machine learning, Artificial Intelligence, DDOC, Data security, Encrypted environment

I. INTRODUCTION

Technological development has enabled the process of data management and business operation faster and more efficient. By utilizing the advanced technology, a more complex data set can be implemented, use and manage easily that effectively improving the business operations and services. In this context, this research is going to demonstrate a deep insight into machine learning in management cloud computing. After the initiation of the digitalization of all kinds of business, domestic and personal activities, the demand for the cloud computing system has been increased rapidly. With the help of such a system, one can store or access data from anywhere by using the cellular or wired connected network system [1]. Now, such circumstances, data stealing and data hacking become a great threat to the researchers and developers as leaking of sensitive or personal data may raise a huge loss for the society and business. In order to prevent such incidents, the collaboration of the machine learning-based algorithm and AI technology brought a secure environment by introducing the AES-256 encryption system. It has been observed that in the current days the majority of the company use cloud computing to keep the data safe and operate their work from different parts of the world and it is considered to be a business platform where production and all data of the business are stored [2]. The main advantage of the AI-based machine learning encryption system is that it can able to analyze the patterns and learn new protective measures from that pattern. Based on this technique, when a similar kind of pattern tries attack further, it immediately takes action against that. The main purpose of the research is to look after the threats and machine learning to develop security in cloud computing.

II. LITERATURE REVIEW

The cloud-computing infrastructure in the current days has developed and it is important to look after security development. However, it is mainly to be looked after by the service providers to develop a robust cloud computing security in the current days. The cloud computing revenue in the UK market has increased and it was almost 15.57 Billion Dollars in the current days. Machine learning and cloud computing along with the "Internet of Things" is considered to be novel technology that has evolved in the IT sector [3]. Various devices are used for the performance of the business along with the use of big data analytics, AI technology has improved the services and looks after the prevention of data in cloud computing.

Various researchers have been identified several issues and security threats regarding cloud security by implementing several machine learning programs. However, cloud computing plays a huge role in the field of machine learning, as it enables the overall cloud data facilities and equipment to boost the technological fields. Although, the cloud system faces too many compliances and disruptions towards achieving huge significance in both the small and large scale companies that operate through information technologies programs in order to enhance their potential growth the business [4]. There are various data encryption formats have been identified through the entire process of identifying threats and security towards implementing machine learning. It has been observed that machine learning

Proceedings of

International Conference on Emerging Trends and Innovation in Engineering and Science (ICETIES) (ICETIES 2022)

14th to 15thOctober 2022

Conveners:

Dr. Vishal N. Sulakhe
Dr. Mangesh D. Nikose

ISBN :- 978-81-958272-6-8

Published on the occasion of ICETIES 2022

Published By: Sandip University, Nashik

Publisher Address:
Trimbak Road, Nashik, Maharashtra, India - 422213.
Website: www.sandipuniversity.edu.in, Email: info@sandipuniversity.edu.in
Contact No: +91 02594-222541/42/43/44

Printer Details: POOJA ENTERPRISES
Shivaji Nagar, Jail Road, Nashik Road, Nashik - 422101.

SANDIP UNIVERSITY
UGC Recognised

Conference Website: www.sandipuniversity.edu.in

Paper ID : 127

ISBN :- 978-81-958272-6-8

A SUMMARY ON IDENTIFICATION OF HETEROGENEOUS CYBER ATTACKS USING MACHINE LEARNING METHODS

Swati Gawand[1], Dillip Rout[2]
[1, 2] Department of computer science and engineering, SUN, Nashik, India.

Abstract: The usage of Internet is growing exponentially nowadays. This is mainly due to the cheaper price of electronic gadgets and data packages as per the recent trend. In fact, Internet is playing a crucial role in everyday life of people in today's world. For instance, people use Internet for browsing, banking, playing games, business, education, watching sports, entertainment, travel, etc. It leads to a sophisticated life where the information is available in the finger tips. On the other, the heavy usage incurs our personal data to be leaked elsewhere in the web without our knowledge. There are multiple ways through which these data can be misutilized. This is generally termed as Cyber security which is a broad field of research covering the essentials of misutilization of data and threats of using Internet. Precisely, the threats are called as Cyber attacks and the detection of such malicious activities on the network is among the oldest and most common problems. Cyber attacks have become common in this Internet world since it has become an integral part of every day's life. Digital wrongdoings are getting expanded consistently and the power of damage. Identifying and staying away from Digital assaults are troublesome undertakings. Cyber crimes and its intensity of damage are getting increased every year. In every sector cyber security has its own importance to secure companies data, and understanding the methods of attack. Protecting information from Cyber attacks like DoS, Phishing attacks, WannaCry attacks, etc., have become more challenging. The rate of Cyber attacks are constantly increasing which makes serious monetary harms to nations and individuals consistently. Cyber security is evolving though detecting and avoiding Cyber attacks are assessed yet to be tedious tasks. Machine Learning (ML) is a subset of Artificial Intelligence and it is useful in predictive analysis. In fact, ML abilities are used by numerous applications including Cyber security issues. In this review paper, we discuss different approaches/methods of ML for identification of Cyber attacks. The mapping between the kind of attacks and the type of ML algorithm used for detecting the respective attack is the main focus of this work.

Keywords: Denial of Service attack (DoS); Wannacry attack; DoS attack; Algorithms.

INTRODUCTION

Security incidents have been reported more frequently recently all across the world. This issue is closely tied to the recent rise in mobile device users who make up the population of connect-from-anywhere terminals, which frequently push the conventional limits of network security. Moreover, the usage of Internet is growing exponentially nowadays. This is mainly due to the cheaper price of electronic gadgets and data packages as per the recent trend. In fact, Internet is playing a crucial role in everyday life of people in today's world. For instance, people use Internet for browsing, banking, playing games, business, education, watching sports, entertainment, travel, etc. It leads to a sophisticated life where the information is available in the finger tips. On the other, the heavy usage incurs our personal data to be leaked elsewhere in the web without our knowledge. There are multiple ways through which these data can be mutualized. This field of study is generally termed as Cyber security which is a broad field of research covering the essentials of misutilization of data and threats of using Internet. Cyber security is growing field and the percentage of Cyber crime is constantly increasing. Network protection is developing and the pace of Cyber crime is continually expanding. Refined assaults are thought of as exceptional, however the new ordinary as they may be turning out to be more regular and boundless. This steady advancement additionally calls for development in the network safety guard. Cyber security protects physical-digital data, networks, and technological systems from Cyber attacks. Cyber attacks such as distributed denial of service attacks by sending malicious packets have increased. Cyber attacks such as distributed denial of service attacks by sending malicious packets have increased.. In addition, increasingly, attackers are deploying malicious attack software that has been secretly placed on the victim's PC. Again, social engineering attacks are the most prevalent of these attacks and one of the attacks that are hardest to stop. Those are built on technical expertise, ingenuity, and persuasion, and they prey on the victim's frailty.There is growing interest in Machine Learning (ML)across a variety of applications including Cyber security. Basically, ML is a subset of Artificial Intelligence and it is useful in predictive analysis. In fact, ML abilities are used by numerous applications including Cyber security issues. In this review article, we discuss different approaches/methods of ML

SEMESTER VIII - Information Technology (SPPU)

Compulsory Subjects

Distributed Systems

Department Level Optional Course – 5	Department Level Optional Course – 6
▸ Software Defined Networks	▸ Ethical Hacking and Security
▸ Social Computing	▸ Augmented and Virtual Reality
▸ Natural Language Processing	▸ Business Analytics and Intelligence
▸ Soft Computing	▸ Blockchain Technology
▸ Game Engineering	

Your Success is Our Goal

eBooks are available on www.techknowledgebooks.com

TechKnowledge Publications

Head Office :
B/5, First Floor, Maniratna Complex, Taware Colony,
Aranyeshwar Corner, Pune - 411009. Maharashtra, India.
Tel. : 91-20-24221234, 91-20-24225678.M.: +91 9370314831

PRINTED ON RECYCLED PAPER

Distribution Address :
Shop No. 8-9, Ground Floor, Shaan Bramha Complex, Appa Balwant Chowk,
Opp. Faraskhana Police Station, Pune - 411002. Mobile : 74989 01813 / 74989 01812.

Our Branches : Pune | Mumbai | Kolhapur | Nagpur | Solapur | Nashik

Email : info@techknowledgebooks.com
Website : www.techknowledgebooks.com

Books are also available at : amazon

Like us at: TechknowledgePublications

ISBN : 978-93-5563-378-1

Price ₹ 265/-

PE194A

SPPU | GAME ENGINEERING | Semester VIII - Information Technology | Book Code PE194A | Price ₹ 265/- | B-25

As per the New Credit System Syllabus (2019 Course) of
Savitribai Phule Pune University w.e.f. academic year 2022-2023

Game Engineering

(Code : 414451 (E)) **(Elective V)**

Semester VIII - Information Technology

Dr. Jaya Gupta Ajit R. Pagar
Tejaswini S. Bhoye Mrunal S. Jagtap Vishal K. Borate

TechKnowledge Publications

2023 1st International Conference on Cognitive Computing and Engineering Education (ICCCEE) | 979-8-3503-3280-3/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICCCEE55951.2023.10424642

Conference Record # 55951
ISBN # 979-8-3503-3280-3
Part Number: CFP23CF5-ART

2023 1st International Conference on Cognitive Computing and Engineering Education (ICCCEE) | 979-8-3503-3280-3/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICCCEE55951.2023.10424494

Organizing Committee

Chief Patrons	
Hon. Prof. Dr. Vishwanath D. Karad Father Founder, MAEER's MIT Group of institutions, President, MIT Art, Design and Technology University Pune	**Hon. Prof. Dr. Mangesh T. Karad** Executive- President & Vice-Chancellor, MIT Art, Design and Technology University, Pune
Hon. Prof. Dr. Anant Chakradeo Pro Vice Chancellor, MIT Art, Design and Technology University, Pune	**Hon. Prof. Dr. Sunita M. Karad** Director ICT, Director MIT COM, MIT Art, Design and Technology University, Pune

Patrons	
Prof. Dr. Virendra V. Shete Director MIT School of Engineering & Science MIT ADT University, Pune, Chair IETE Pune Section, Chair IEEE Education Chapter Pune Section	**Prof. Dr. Rajeensh Kaur Sachdeo** Director MIT School of Computing, Pune MIT ADT University, Pune
Prof. Dr. Ramachandra Pujeri Dean MIT School of Computing, Dean Student Affairs, Director-Strategic Planning Cell & CIIP MIT ADT University, Pune	**Prof. Dr. Sudarshan Sanap** Dean MIT School of Engineering & Science, Head Mechanical Engineering, MIT ADT University, Pune
Prof. Dr. Kishore Ravande OSD to Vice Chancellor, MIT ADT University, Pune	**Er. Girish Khilare** Immediate Past Chair, IEEE Pune Section
Dr. Surekha Deshmukh Chair, IEEE Pune Section, Chair, SIG Renewable Energy, Pune	

General Chair	
Hon. Prof. Dr. Sunita M. Karad Director ICT, Director MIT COM, MIT Art, Design and Technology University, Pune	**Prof. Dr. Virendra V. Shete** Director MIT School of Engineering & Science MIT ADT University, Pune, Chair IETE Pune Section, Chair IEEE Education Chapter Pune Section
Dr. Vivek Deshpande Chair, Conference Committee	

2023 1st International Conference on Cognitive Computing and Engineering Education (ICCCEE)
MIT ADT University Pune, India. Apr 27-29, 2023

Improvised Ensemble Model for Fast Prediction of DoS/DDoS Attacks in Various Networks

Santosh Gore
Director, Sai Info Solution, Nashik,
Maharashtra, India
*sai.info2009@gmail.com
https://orcid.org/0000-0003-1814-59131*

Y. Nagalakshmi
Assistant professor, Department of ECE
Geethanjali College of Engineering and Technology
Cheeryal village, Keesara mandal, Medchal district
Telangana
ynagalakshmi.ece@gcet.edu.in

Dr. Prem Knowles
Assistant Professor, Department of Management Studies
Madanapalle Institute of Technology & Science
Madanapalle, Andra Pradesh
premknowles@gmail.com

Dr. K Gurnadha Gupta
Assistant Professor, Department of CSE-HONERS,
KL Deemed to be University, Green Fields,
Vadeswaram- 522502, Guntur, Andhra Pradesh, India
kbgrguptha@gmail.com

Nalini S Jagtap
Assistant Professor
Dr D Y Patil Institute of Engineering Management and Research
nalinisjagtap@gmail.com

Radha Pranav Sali
Assistant professor
Guru gobind Singh College of engineering and research centre,
Nashik
radhasali123@gmail.com

***Abstract*-- This study investigates the application of machine learning techniques for detecting and mitigating the growing threat of DoS/DDoS attacks in online activities. With the increasing reliance on technology, ensuring the security of computer networks is of utmost importance. Our focus is on effective detection of DDoS attacks, where the victim's computer is overwhelmed by traffic from multiple sources. We propose the use of ensemble methods and leverage two datasets, namely the MyHomeNetwork Traffic Dataset and the NSL-KDD dataset, to evaluate the detection accuracy. By employing various machine learning classification algorithms, our system accurately identifies DDoS attacks with an impressive 99% accuracy rate. These findings underscore the efficacy of our approach in safeguarding computer networks against DDoS threats.**

Keywords: NSL-KDD, Wireshark, TCP Flood, Dataset, DoS Attack, WinPCaP.

I. INTRODUCTION

The Global Connection has decreased travel times but rendered our systems more vulnerable to malicious attackers. We must protect our data. DoS attacks flood the victim's PC with hacker traffic. Victim's PC crashes after the attack. The attack aims to overload and crash the victim's server. DoS attacks are online dangers. After an attack, website users can't use it. The hacker's system bombards the target website's server to interrupt its services. If it's a network, a trustworthy server means users can't access it anymore. DoS assaults can wipe out market competitors. Attackers attacked internet companies with DoS attacks and demanded money for victim protection. Individual attackers often exploit server vulnerabilities to disrupt services. To overcome the limitations of single-computer attacks, recent denial-of-service (DoS) attacks have utilized distributed networks of attacking sites on the internet, resulting in Distributed Denial of Service (DDoS) assaults. In this study, we propose an improved method for detecting DDoS attacks. Machine learning techniques have emerged as effective tools for DDoS detection, where the system analyzes incoming packets to determine their maliciousness. Classification methods are employed to evaluate the performance of the system. For data collection, we utilize Wireshark and the WinPcap Tool, which capture streaming network packet traffic.

Three sorts of network security issues can be distinguished: unauthorised denial of service, lack of authenticity, and confidentiality violations. These issues encompass various threats and vulnerabilities in the network environment. Numerous terms for "embezzlement" have been created to characterize various types of DoS attacks. One encapsulating term, DDoS, implies that the attack is originating from a variety of unrelated sources. DDoS attacks fall under the DoS attack category. DDoS attacks are ICMP (Ping), TCP-SYN, and UDP floods.

A. ICMP Flood Assault:

An Internet Control Message Protocol flood DDoS assault, also known as a Ping flood attack, overloads a device or server with multiple ICMP echo requests or ping requests.

B. TCP-SYN Flood Assault:

This assault could affect every internet-connected device that is linked to the system. When a victim host responds with a SYN-ACK, the sender continually makes a large number of SYN requests while ignoring the victim host's response and continuing to send series of SYN requests from a fictitious IP address.

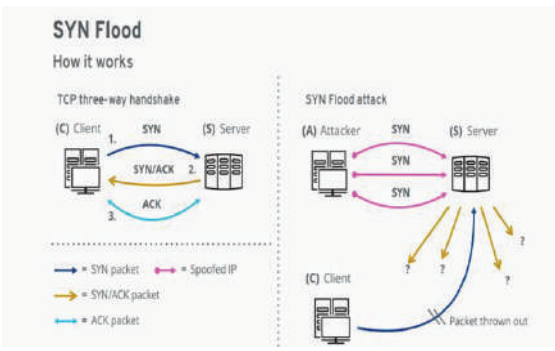


Fig. 1. HOW SYN Flood attack happens

2023 1st International Conference on Cognitive Computing and Engineering Education (ICCCEE) | 979-8-3503-3280-3/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICCCEE55951.2023.10424447

2023 World Conference on Communication & Computing (WCONF)
Raipur, India. July 14-16, 2023

Optimal utilization of UPQC using Rao-2 Algorithm

1st Swati Gade
Electrical Engineering Department,
Sandip Institute of Engineering and Management,
Nashik-422213, India
swatiagade@gmail.com

2nd Rahul Agrawal
Electrical Engineering Department,
Guru Gobind Singh College of Engineering and Research Centre
Nashik-422213, India
yourrahul1@gmail.com

3rd Rakesh Jha
Electrical Engineering Department,
Sandip Institute of Engineering and Management,
Nashik-422213, India
rakeshshanti@gmail.com

4th Dipak Patil
Electronics and Telecommunication Engineering Department,
Sandip Institute of Engineering and Management,
Nashik-422213, India
dipakpatil25@gmail.com

***Abstract*—Nowadays for compensation for various power quality issues a unified power quality conditioner (UPQC) is found the most suitable and effective compensating device. Variable phase angle control method used to control both power electronic converters (PEC) improves the utilization making the UPQC efficient and economical. Rao-2 algorithm is used to optimize the utilization of UPQC in this research paper. The superiority of the Rao-2 algorithm over the JAYA algorithm is demonstrated through a comparison of the output results. This article will aid researchers in the development of improved control systems based on optimization techniques for the most efficient use of UPQC.**

***Index Terms*—Optimization, Power Electronic Converter, Power Quality, Rao-2 algorithm, Solar PV- UPQC**

I. Introduction

Application of nonlinear equipment such as power electronic converters (PEC), and electric arc furnaces introduces various power quality (PQ) issues [1]. Huge financial loss and poor power factor (PF)due to interruption of the supply are the severe consequences of voltage sag, voltage swell, flickers, excessive neutral current, voltage unbalance, harmonics, etc. [2]. PQ Standardization is very essential for maintaining the PQ of supply [3]. An active Power Filter (APF) could be a good solution to mitigate these PQ issues. However, a Unified Power Quality Conditioner (UPQC), which is from the APF family is found suitable and efficient to mitigate this PQ issues [4].

In addition to other Renewable Energy Sources (RES), solar photovoltaic (PV) systems are increasingly gaining popularity since they can provide the necessary dc voltage at a fair price. PEC is used to connect solar power supplies to utility grids safely. However, this technique also introduces a variety of PQ issues [5]. The circuit diagram of the three phases of UPQC is shown in Fig. 1. Simultaneous series and shunt compensation is a unique feature of UPQC and therefore it is mainly used in distribution system [6].

UPQC is the most favorite compensating device among researchers. Therefore, researchers are continually trying to discover the best controlling technique for effective utilization of UPQC in various applications [7]. Based on the method of compensation the UPQC is classified as shown in Fig. 2.

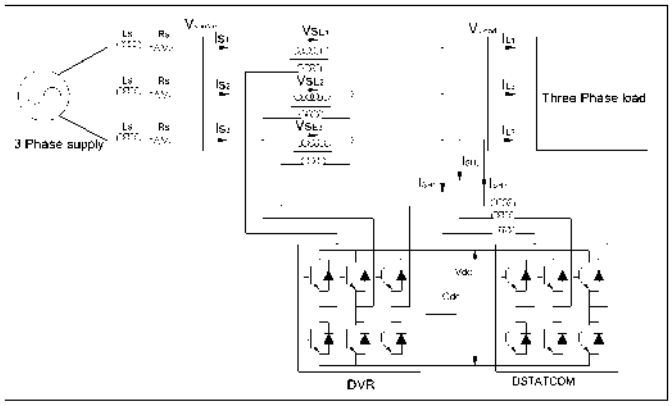


Fig. 1. Three Phase UPQC Structure

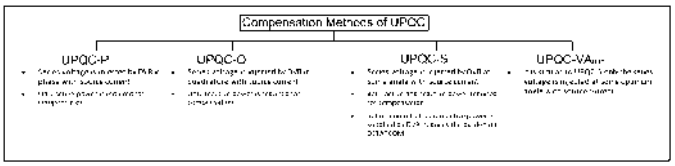


Fig. 2. UPQC classification

In the case of UPQC-S and UPQC-VA_{min}, Voltage sag and swell are compensated by series PEC along with a small amount of reactive power compensation [8]. The remaining reactive power required is supplied by Shunt PEC. The performance of the UPQC is enhanced when the series voltage is injected with the source current at an optimum angle [9]. This is because the utilization of series PEC is increased which reduces the burden on shunt PEC. As a result, the system's overall cost decreases, increasing its economic potential [10]. Instead of traditional approaches, the majority of researchers

979-8-3503-1120-4/23/$31.00 ©2023 IEEE

used phase angle control (PAC) to control UPQC [11].
B. B. Ambati suggested a method for UPQC designing that is based on the optimal rating of both PECs [12]. The correlation between the VA loadings of series and shunt PEC in terms of the magnitude of voltage sag/swell, and the angle was derived from the mathematical model of UPQC. From this mathematical model for the worst operating conditions, the fixed optimal angle is determined at which the use of UPQC will be maximum. Similarly, UPQC design using variable PAC is presented by J.Ye et al [13].
From the literature on the optimum design of UPQC, it is concluded that for optimum utilization of both PECs power angle δ is controlled. To determine optimum power angle δ at various operating conditions different optimization techniques such as particle swarm optimization [14], Teaching learning-based optimization (TLBO) [15], JAYA optimization [16] are proposed by researchers.
Determining the optimal VA loading for series and shunt PEC during voltage sag and steady-state conditions was the primary objective of this work. To find the optimal utilization of UPQC advanced optimization algorithm called as Rao-2 algorithm was used. To analyze the efficacy of the proposed method the output results were compared with the JAYA optimization.
Recently algorithm-specific-parameterless algorithms such as TLBO [17], JAYA [18] and Rao algorithms [19] have been proposed by V. Rao. With the help of these algorithms, the issues of proper tuning of algorithm-specific parameters, which can lead to higher computational burden and poor algorithm performance, are resolved. The contributions of this research article are:

1) Application of Rao-2 algorithm for optimal utilization of UPQC during voltage sag, and steady-state.
2) Analyzing the performance of Rao-2 and JAYA algorithm for the same.

The remaining paper is structured as follows: Section 2 covers the formulation of optimization problem. Optimization techniques Rao-2 algorithm is briefly explained in Section 3. Application of Rao-2 algorithm for optimal utilization of UPQC is explained in Section 4. Results and discussions are explained in Section 5. The Paper is concluded in Section 6.

II. PROBLEM FORMULATION

The working of UPQC is shown in Fig. 3. It is clear that in order to maintain the optimum angle δ between the load and source voltage series PEC must inject voltage V_{SE} in series at the appropriate phase angle.

A. Mathematical Modeling

In this research work the mathematical modeling of UPQC presented by B. B. Ambati in Ref. [14] is considered.
Series voltage injected is given by,

$$V_{SE}\left(\delta, K\right) = \sqrt{(V_{Load}cos\delta - KV_{Source})^2 + (V_L sin\delta)^2} \tag{1}$$

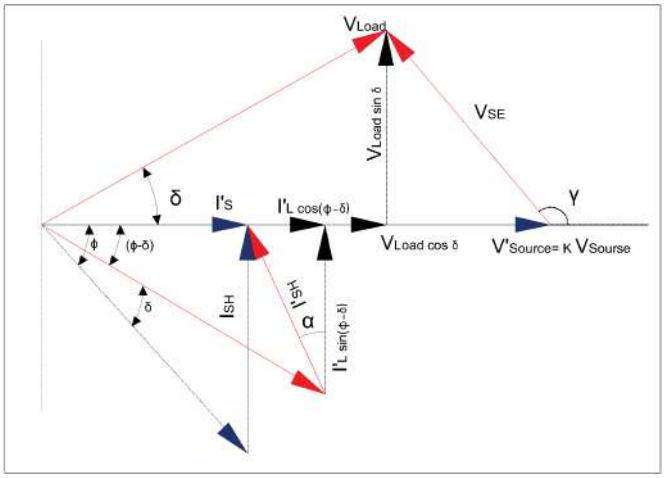


Fig. 3. Phasor diagram explaining working of UPQC

Loading of the series PEC in VA,
$S_{seriesPEC}\left(\delta, K\right)$

$$= \sqrt{(P_{seriesPEC}\left(\delta, K\right)^2 + (Q_{seriesPEC}\left(\delta, K\right))^2} \tag{2}$$

Loading of the series transformer in VA,
$S_{SETrans}\left(\delta, K\right)$

$$= max\,of\left[\sqrt{(V_L cos\delta - KV_S)^2 + (V_L sin\delta)^2}\right]_{K_{min}}^{K_{max}} \frac{I_S}{K} \tag{3}$$

Loading of shunt PEC in VA,
$S_{shuntPEC}\left(\delta, K\right)$

$$= \sqrt{(P_{shuntPEC}\left(\delta, K\right))^2 + (Q_{shuntPEC}\left(\delta, K\right))^2} \tag{4}$$

Total Loading of the UPQC in VA,

$$S_{UPQC}\left(\delta, K\right) = S_{seriesPEC}\left(\delta, K\right) + S_{shuntPEC}\left(\delta, K\right) \tag{5}$$

B. Formulation of Objective Function

The main objective of this research work is to optimize the utilization of UPQC. The objective function is expressed as below,
$Min.\, S_{UPQC}\left(\delta, K\right)$

$$= S_{seriesPEC}\left(\delta, K\right) + S_{shuntPEC}\left(\delta, K\right) \tag{6}$$

It is bounded by inequality constraints,

$$S_{seriesPEC}\left(\delta, K\right) \leq Rating\,of\,seriesPEC, \tag{7a}$$

$$S_{shuntPEC}\left(\delta, K\right) \leq Rating\,of\,shuntPEC, \tag{7b}$$

$$V_{SE}\left(\delta, K\right) \leq Max\,voltage\,injected\,by\,series\,transformer, \tag{7c}$$

Design variable constraints considered,

$$0 \leq \delta \leq 45^o \tag{8}$$

$$0.6 \leq K \leq 1.4 \tag{9}$$

Input: n-Population size or number of candidates

m- Number of design variables

Z- Maximum number of iterations

X – Population

Output: f_{Best} – Best solution of fitness function

f_{Worst} – Worst solution of fitness function

x^i_{jbest} – Best candidate of fitness function

x^i_{jworst} – Worst candidate of fitness function

Start

1: ***for k=1: n do*** (i.e., population size)

2: ***for j=1:m do*** (i.e., design variables)

Initialize population (x^i_{jk})

end

end

Evaluate x^i_{jbest} and x^i_{jworst} (Based on the solution of the fitness function)

3: ***set i =1*** (Initialize iteration number)

while maximum number of iterations (Z) is not meet

4: ***for k=1: n do*** (i.e., population size)

5: ***for j=1:m do*** (i.e., design variables)

set r^i_{1j} = a random number from [0,1]

set r^i_{2j} = a random number from [0,1]

update using following equation,

$$x^{i+1}_{j,k} = x^i_{j,k} + r^i_{1j}(x^i_{j\,best} - x^i_{j\,worst}) + r^i_{2j}(|x^i_{jk}|\ OR\ |x^i_{jl}| - |x^i_{jl}|\ OR\ |x^i_{jk}|)$$

end

6: ***if*** solution f^{i+1}_{jk} better than f^i_{jk} (Based on the solution of the fitness function)

set $x^i_{jk} = x^{i+1}_{jk}$, $f^i_{jk} = f^{i+1}_{jk}$

else

set $x^{i+1}_{jk} = x^i_{jk}$, $f^{i+1}_{jk} = f^i_{jk}$

end

end

set $i=i+1$

update x^i_{jbest} and x^i_{jworst}

7: ***end while*** *termination criterion satisfied*

end

Fig. 4. Pseudocode for Rao-2

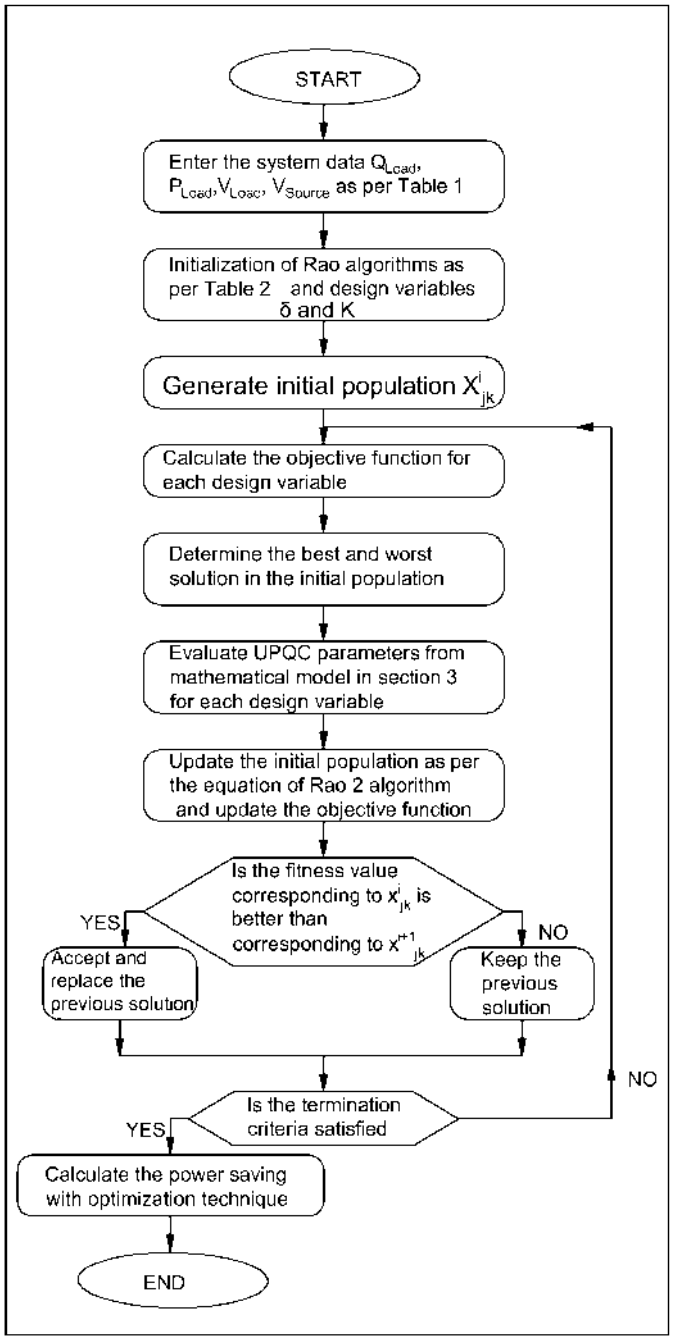


Fig. 5. Flow chart: Optimal utilization of UPQC using Rao-2 Algorithm

III. RAO-2 ALGORITHM

A mathematical branch called optimization aims to discover the optimized design of a physical system under a set of constraints. The accuracy and lengthy computation period of traditional optimization methods are the main constraints on their use. Numerous advanced intelligent optimization techniques have recently been developed to tackle these issues. One of the intelligent optimization algorithm Rao-2 is explained in this section .

In Rao-2 algorithm the candidate solution at every iteration is updated as follows:

$$x^{i+1}_{j\,k} = x^i_{j\,k} + r^i_{1j}\{x^i_{j\,best} - x^i_{j\,worst}\}$$

$$-r^i_{2j}\{|\ x^i_{j\,k}\ OR\ x^i_{j\,l}\ | - |\ x^i_{j\,l}\ OR\ x^i_{j\,k}\ |\} \qquad (10)$$

in Rao-2 algorithm, fitness value of the k^{th}candidate solution is compared to any random solution and the information is exchanged. The pseudo code for Rao-2 algorithm is shown in Fig. 4.

IV. OPTIMAL UTILIZATION OF UPQC USING RAO-2 ALGORITHM

In this study in order to maintain unity PF and to compensate PQ issues, the UPQC with a 40% compensation capability is integrated into the system. The Fig. 5 depicts the flow chart of the Rao-2 algorithm implementation for optimal utilization of UPQC. The Fig. 6 shows the system under consideration

(load and rating of series and shunt PEC are given in the figure). The algorithmic parameters applied in this work are listed in Table I.

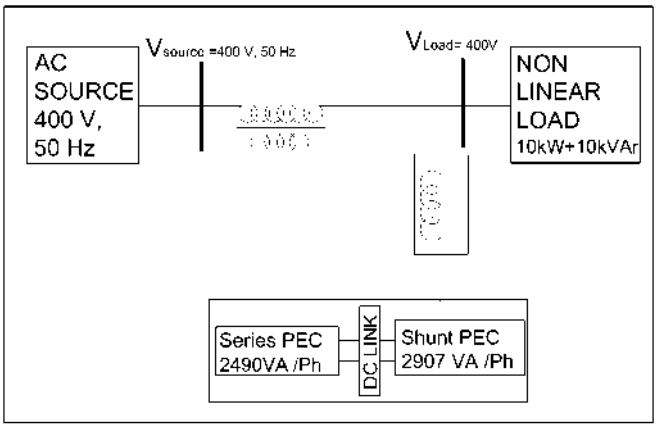


Fig. 6. System under consideration

TABLE I
ALGORITHM PARAMETERS

Parameter	Value
Variables	2
Population Size	50
Iteration	50
random	[0,1]

V. RESULTS AND DISCUSSION

MATLAB environment was used to run the proposed algorithms. Parameters given in Fig. 6 and Table I were used for the simulation. System presented in Ref. [14] was used for this research. Table II presents the output results without optimization. According to the output data to compensate for the voltage sag, the UPQC-P approach required larger VA loading on both PECs and ultimately increases the loading of the UPQC. However, with UPQC-VA_{min} approach some amount of reactive power is compensated by series PEC which results in a reduction in the overall loading of UPQC.

TABLE II
VA LOADING OF CONVERTERS WITHOUT OPTIMIZATION

	K pu	Angle δ	V_{inj} (V)	VA Loading(VA) DVR	DSTATCOM	UPQC
UPQC-P	0.6	0	93	2223	4007	6230
	1	0	0	0	3334	3334
UPQC-VA_{min}	0.6	38^o	148	3577	1048	4625
	1	0	0	0	3334	3334

Output results with JAYA and Rao-2 algorithms are presented in Table III. From this results it is conclude that as compared to JAYA algorithm, the Rao-2 algorithm has a minimum optimal angle δ. This results in minimum series voltage required for voltage sag compensation and thus the load on the series transformer is minimized. The optimal use of UPQC during voltage sag and steady-state conditions is analyzed and presented in the following subsection.

TABLE III
VA LOADING OF CONVERTERS WITH JAYA AND RAO-2 ALGORITHM

	Sag		Steady-State	
	JAYA	Rao-2	JAYA	Rao-2
K	0.9	0.9	0.941	0.964
Angle	27.5	25.1	23.370	15.310
V_{SE}	106.680	98	91.76	61
S_{SE}	1710.85	1571.240	1407.5	913
S_{SH}	1623.86	1762.340	1930	2420.22
$S_{TRANS.}$	2013.620	1936.280	1546	1026.2
S_{UPQC}	3334.720	3333.580	3337.500	3333.220

A. Analysis during Voltage sag

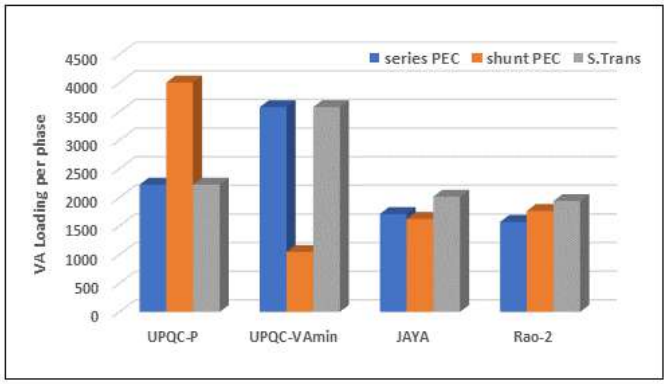


Fig. 7. Loading during Voltage sag condition

By changing the value of K in the range of 0.6 to 0.9 pu, the voltage sag condition is established. The VA loading of series PEC, shunt PEC and with series transformer is shown in Fig. 7. From the Fig. 7 it is observed that, the loading of series PEC, shunt PEC and series transformers is significantly reduced with optimization.

To maintain the unity PF at the source side load reactive power required is supplied via shunt PEC in UPQC-P approach and via series PEC in UPQC-VA_{min} approach. However, in JAYA and Rao-2 algorithm approaches some amount of reactive power is used for compensation which results in reduced burden on shunt PEC. From the outcomes, it is found that with JAYA algorithm series PEC share around 60% load reactive power and remaining by shunt PEC. On the other hand, with Rao-2 algorithm around 47% load reactive power is shared by series PEC and remaining by shunt PEC.

The convergence characteristics of Rao-2 algorithm is shown in Fig. 9. From the convergence characteristics and statistical analysis (refer Table IV) it is concluded that the value of the standard deviation (SD) of the Rao-2 algorithm, which is the lowest (0.06345) compared to the JAYA algorithm, confirms

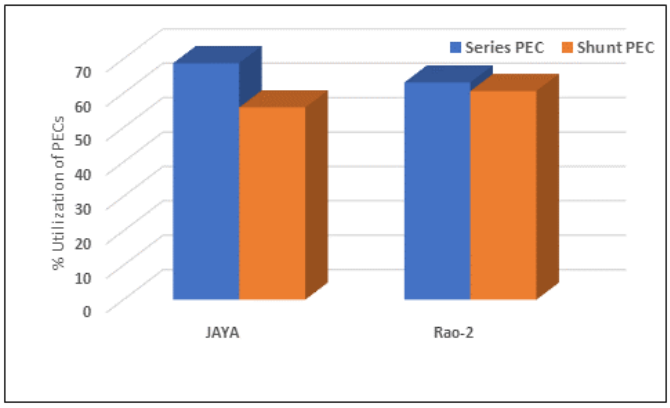


Fig. 8. % Utilization of PECs during voltage sag condition

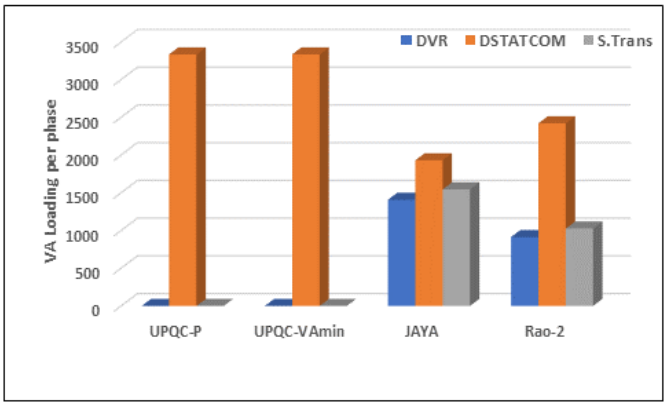


Fig. 10. Loading during steady state condition

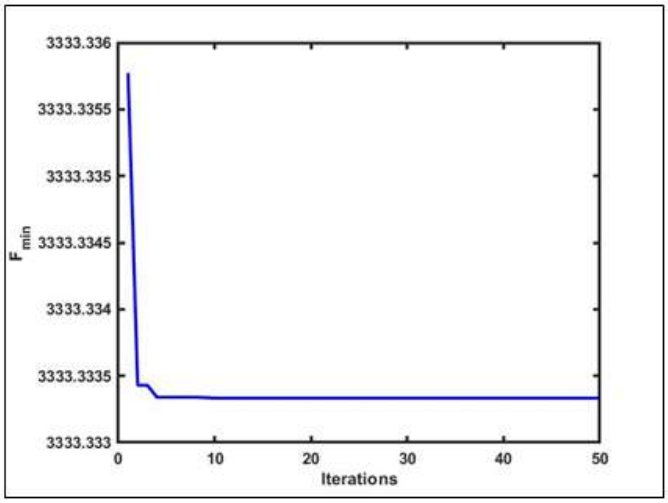


Fig. 9. Rao-2 algorithm Convergence graph during voltage sag

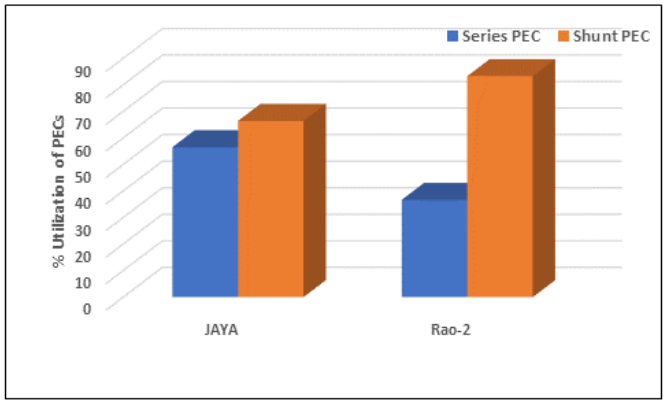


Fig. 11. % Utilization of PECs during steady state condition

its robustness and potential to obtain the optimal solution in every test.

B. Analysis during Steady state

In the simulation, the steady state condition is created by changing the design variable K in the range of 0.9 to 1.1 pu. The loading of both PECs and transformers is shown in Fig. 10. In case of traditional approaches the source side PF is maintained to Unity PF by supplying the required load reactive power via shunt PEC. However, output results of the proposed algorithms shows that utilization of UPQC is improved because load reactive power required by system is supplied by both PECs. It is found that out of total required load reactive power around 35% reactive power is supplied by series PEC and remaining reactive power is compensated by shunt PEC. The steady-state convergence graph of Rao-2 algorithm is shown in Fig.12. The statistical analysis (refer Table IV) and convergence characteristics shown in Fig.12 clearly demonstrate that the Rao-2 algorithm's robustness and potential to obtain the optimal solution in each test are validated by the value of SD (0.00158317) when evaluated by comparing to the JAYA algorithm.

TABLE IV
ANALYSIS OF OPTIMIZATION TECHNIQUES

	Sag		Steady-State	
	JAYA	Rao-2	JAYA	Rao-2
MINI	3333.549	3333.58	3353	3333.333
MEAN	3334.168	3334.038	3117	3333.339
BEST	3333.549	3333.58	3353	3333.333
WORST	40233568	3334.78	3498	3333.384
SD	0.111372	0.06345	18.53	0.00158317

VI. CONCLUSION

In this research paper a unique algorithm using Rao-2 algorithm is proposed which is used to find the optimal values of K and angle δ for optimal use of UPQC. To show the efficacy of the proposed technique using Rao-2 algorithm the results are compared with that of JAYA algorithm. In addition to this, the Rao-2 algorithm reaches to the global optimum parameters relatively quicker than the JAYA algorithm. The unique features of this method are it is a algorithm-specific parameter-less algorithm and variable PAC method is used

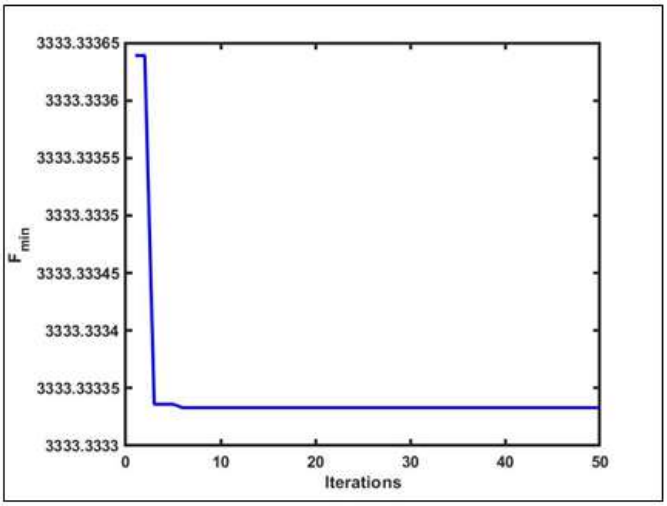


Fig. 12. Rao-2 algorithm Convergence graph during steady state

for compensation. Power loss and ultimately the cost of manufacturing the UPQC system are reduced when PECs of UPQC are used within their maximum efficiency region. This increases the attractiveness of the UPQC as a realistic approach for the mitigation of PQ issues and incorporating RES into the main grid. To improve the efficiency and loading of UPQC, this research will assist researchers in developing new UPQC control methods based on optimal instantaneous loading.

REFERENCES

[1] R. C. Dugan, M. F. McGranaghanand H. W. Beaty, Electic Power System Quality. New York: cGraw-Hill, 1996.

[2] Bhim Singh, Ambarish Chandra, Al-Haddad, "Power Quality Problems and Mitigation Techniques", John Wiley and Sons, Ltd, First Edition, 2015.

[3] IEC 61000-2-1: 1990.

[4] H. Fujita and H. Akagi, "The unified power quality conditioner: The integration of series- and shunt-active filters," IEEE Trans. Power Electron., vol. 13, no. 2, pp. 315–322, 1998.

[5] V. Khadkikar, "Enhancing electric power quality using UPQC: A comprehensive overview," IEEE Transactions on Power Electronics, vol.27, no. 5, pp. 2284–2297, 2012.

[6] M. T. L. Gayatri and A. M. Parimi, "Mitigation of supply and load side disturbances in an AC Microgrid using UPQC," in IEEE 6th International Conference on Power Systems, ICPS 2016, 2016

[7] Gade, S., Agrawal, R., & Munje, R. Recent Trends in Power Quality Improvement: Review of the Unified Power Quality Conditioner. ECTI Transactions on Electrical Engineering, Electronics, and Communications , 19 (3), 268–288, 2021.

[8] V. Khadkikar and A. Chandra, "UPQC-S: A novel concept of simultaneous voltage sag/swell and load reactive power compensations utilizing series inverter of UPQC," IEEE Trans. Power Electron., vol. 26, no. 9, pp. 2414–2425, 2011.

[9] Y. Y. Kolhatkar and S. P. Das, "Experimental investigation of a single-phase UPQC with minimum VA loading," IEEE Trans. Power Deliv., vol. 22, no. 1, pp. 373–380, 2007.

[10] Y. Y. Kolhatkar, R. R. Errabelli, and S. P. Das, "A sliding mode controller based optimum UPQC with minimum VA loading," in 2005 IEEE Power Engineering Society General Meeting, 2005, vol. 1, pp. 871–875,2005.

[11] 11. V. Khadkikar, Fixed and variable power angle control methods for unified power quality conditioner: Operation, control and impact assessment on shunt and series inverter kva loadings, Power Electronics, IET 6, 1299–1307, (2013).

[12] B. B. Ambati and V. Khadkikar, "Optimal sizing of UPQC considering VA loading and maximum utilization of power-electronic converters," IEEE Trans. Power Deliv., vol. 29, no. 3, pp. 1490–1498, 2014.

[13] J. Ye, H. B. Gooi, and F. Wu, "Optimal Design and Control Implementation of UPQC Based on Variable Phase Angle Control Method," IEEE Trans. Ind. Informatics, vol. 14, no. 7, pp. 3109-3123, 2018.

[14] Swati A. Gade and R. Agrawal, "Utilization of UPQC During Voltage Sag and Steady-State Using Particle Swarm Optimization",Chapter 37, Intelligent Computing in Information Technology for Engineering System by CRC press, 2022.

[15] S. Gade, R. Agrawal, D. Patil and S. Antonov, "Optimal Utilization of UPQC at Different Operating Condition Using TLBO," 2021 56th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST), 2021, pp. 197-200.

[16] Swati Gade and Rahul Agrawal (2021) Optimal utilization of unified power quality conditioner using the JAYA optimization algorithm, Engineering Optimization, DOI: 10.1080/0305215X.2021.1978440

[17] R. V. Rao, V. J. Savsani, and J. Balic, "Teaching-learning-based optimization algorithm for unconstrained and constrained real-parameter optimization problems," Eng. Optim., vol. 44, no. 12, pp. 1447–1462, 2012, doi: 10.1080/0305215X.2011.652103.

[18] R. Venkata Rao, "Jaya: A simple and new optimization algorithm for solving constrained and unconstrained optimization problems," Int. J. Ind. Eng. Comput., vol. 7, no. 1, pp. 19–34, 2016, doi: 10.5267/j.ijiec.2015.8.004.

[19] R. V. Rao, "Rao algorithms: Three metaphor-less simple algorithms for solving optimization problems," Int. J. Ind. Eng. Comput., vol. 11 (1), pp. 107–130, (2020).

Lecture Notes in Electrical Engineering 1117

Vasundhara Mahajan
Anandita Chowdhury
Sri Niwas Singh
Mohammad Shahidehpour *Editors*

Emerging Technologies in Electrical Engineering for Reliable Green Intelligence

Proceedings of ICSTACE 2023

Springer

Vasundhara Mahajan · Anandita Chowdhury ·
Sri Niwas Singh · Mohammad Shahidehpour
Editors

Emerging Technologies in Electrical Engineering for Reliable Green Intelligence

Proceedings of ICSTACE 2023

Springer

Standalone Photovoltaic Fed Water Pumping System with Better Performance Using P&O MPPT Techniques

Prasad R. Phad, Urmila M. Mathure, Vishakha A. Chavan, and Sonali P. Gosavi

Abstract The proposal's key idea is to build a solar power system that Indian farms would employ. With the ability to pump water from rivers or other sources, this solar device will do away with the need for diesel-powered pumps, which is a costly farming practice. This new solar gadget should have a reasonable and cost-effective capacity to pump water into the ground for irrigation purposes. Many farmers in India currently use diesel engines to fetch water from sources for their agricultural needs. However, overcoming the drawbacks of diesel engines requires routine maintenance and repair, which costs farmers a lot of money every day. I picture solar energy replacing the diesel engine. Additionally, the solar energy system is useful for lighting up the farm at night in addition to creating electricity that will be used to pump water into the farms. Energy from the solar system is drawn from a reliable source, particularly in India. It will be a safe, clean source of energy that won't endanger the environment or the natural world. Additionally, it won't affect the planet. The developed system is a complete standalone system in which electrical power from the solar module is directly supplied to the induction motor drive. The proposed system uses a three-phase induction motor drive with a water pump and solar module to generate electrical power to operate the motor drive and pump. For the operational point of view, P&O technique was chosen from a comparative study of various MPPT techniques. In the proposed system, for attaining peak power from solar modules even in a variety of irrigation conditions the technique called P&O is used. P&O achieved maximum capacity output from solar modules and produced the necessary torque and speed even at low radiation.

Keywords Solar panel · Water pumping incremental conductance · Induction motor drive · Etc

P. R. Phad (✉) · U. M. Mathure · V. A. Chavan · S. P. Gosavi
Department of Electrical Engineering, GCOERC, Nashik, India
e-mail: pphad035@gmail.com

V. Mahajan et al. (eds.), *Emerging Technologies in Electrical Engineering for Reliable Green Intelligence*, Lecture Notes in Electrical Engineering 1117,
https://doi.org/10.1007/978-981-99-9235-5_23

1 Introduction

Kindly consider that the initial paragraph of a section or subsection is not indented. An indent is not used for the primary paragraphs after a table, figure, calculation, etc. The worldwide energy shortage and the loss of natural ecosystems have come to the attention of technology and research. For a few years, the Fraternity, the amount of information about converting renewable energy sources into usable energy forms has been growing quickly. Energy conversion is greatly aided by the development of semiconductor playback devices and quick switching electronic devices. The use of renewable technology, which began right away today, ranged from converting solar energy to transforming running water resources into power. An earlier method of converting solar energy, known as photovoltaic (PV), has a relatively high cost and a performance that is only approximately 6–7%. However, with improved technical effort, a PV array's performance is currently between 14 and 15%. The rates on the other side are gradually falling. With less hazardous pollutants, no greenhouse gas emissions, no involvement in fuel pricing, lower maintenance costs, and the elimination of water consumption, solar energy is increasingly being used to generate power. However, research is expanding, and various restrictions such as intermaturity, higher capital costs, and worse efficiency need to be improved. In addition to being utilized for irrigation, drainage, and water treatment facilities in remote places, solar water pump systems are becoming more popular in rural, grid-less areas. Irrigation is crucial for producing quality food in India, since 70% of the population is dependent on agriculture. Additionally, there are water pumps that run on conventional or electrical energy. Solar-operated water pumping systems outperform diesel-powered water pumping systems in terms of price and emissions. Creative solutions to the operational problem of variable power generation while providing maximum power and water pumping are required when designing a motor drive unit that is directly powered by a solar panel. Due to its shoddy construction, an induction motor drive (IMD) in a solar pumping system exhibits respectable efficiency when compared to other motors. The development of a powerful, inexpensive, reliable, and secure solar water pumping system is suggested.

2 Literature Review

A. Audenaert, L. De Boeck, S. De Cleyn, J.-F. and S. Lizin. Adam, recommended evaluating the Linked Networks Photovoltaic Grid economically [2]. Priyvrat Vtas, presented, stating that the SPV array system, which transforms dc-dc to buck-boost, is thought to be the source of power for single-phase IM drive water pumping [3]. This paper proposed a three-stage power conversion using buck-boost and VSI converters. The primary restriction in the first stage is to utilize PV to its utmost potential, which is accomplished by controlling MPPT. The V to SPW. M. Sreejeth, P. and M. Singh Kumar, proposed gadget was put to the test at the IM under various load torque

scenarios. A little difference in the induction motor speed was noticed. According to certain reports, the induction motor can reach constant velocity faster when utilizing v/f. In addition, the production of the machine is very high [4]. S. And Shukla and B. Singh, proposed single stage SPV array speed sensor feed less induction motor drive vector control for water pumping [5].

D. P. Hohm and M. E. Ropp, suggested using PI and fuzzy logic controllers to develop and simulate an effective solar water pumping system (FLC) [6]. B. Subudhi and R. Pradhan suggested the System uses a maximized power point monitoring method (MPPT) algorithm utilizing P&O and Increment conductions. The suggested computer is a turbine power, a charger, an inverter and a submersible device [7].

Gupta, S., Rajaji, L. & S. Kalika, suggested MPPT controller architecture and implementation in the Solar PV framework for differing radiance [8]. Bhim Singh, Shailendra Kumar, and Utkarsh Sharma proposed a novel, standalone water pumping system with solar power that is especially well suited for use in rural or distant areas has been proposed. The system's main purpose is to lower expenses and uncertainty while maximising the utilization of the photovoltaic generator. The ease of operation, maintenance, and support is ensured by the use of standard hardware and control systems. A water pump powered by an induction motor drive and managed by a traditional field-oriented control system is the suggested remedy. The boost converter and VSI are directly connected to the photovoltaic array through a DC contact. Using AC power, the IMD and pump are connected [1]. Bhim Singh and Utkarsh Sharma, proposed Grid-interfaced solar water pumping method in three steps with detailed power point tracking using neural networks (MPPT) A depiction of a solar array is built using the MATLAB Simulink Simulation Architecture. The Simulink principle is tested under various temperature and light-exposure situations, and the related I–V and PV characteristics show that the Simulink PV array definition is valid. In this paper, a neural network with multilayer is trained using the back propagation training algorithm utilizing data generated from a Simulink model of a PV set under various irradiations and temperatures. The generated data from the system is then evaluated using a neural network. A neural network will accurately anticipate a solar array's maximum power point [9].

T. Undeland and N. Mohan, "Power Electronics: Converters, Technologies and Architecture. Specific converters and power transitions are researched from the proposed paper [10] and other theoretical definition analyzes from other online sources [11,12, 13].

After reading through all of these publications, it is clear that there are certain drawbacks to the idea of a standalone photovoltaic water pumping device utilizing an induction motor drive method.

3 Methodology

In rural areas with no infrastructure, solar water pumps are more common. These pumps are also utilized in rural areas for water treatment facilities, irrigation, and drainage. In India, agriculture is the primary source of income for 70% of the population, hence irrigation is crucial. Currently, many water pumps in rural regions use electricity or other conventional energy sources to function, however, solar water pumping systems are more useful and efficient in grid-down locations than diesel engines. In comparison to alternative motor drives, the induction motor drive performs better in the suggested system. The proposed technology has evolved to create an effective, dependable, maintenance-free, and cost-effective water pumping system using solar modules. The developed system is a complete standalone system in which electrical power from solar module is directly supplied to the induction motor drive. The proposed system uses a three-phase induction motor drive with a water pump and solar module to generate electrical power to operate the motor drive and pump. P&O technique is used in the proposed system to obtain peak power from solar module even in different irrigation conditions. P&O achieved maximum capacity output from solar module and produced the required torque and speed even at low radiation. P&O technique is chosen for the operational point of view after a comparative analysis of various MPPT techniques. As a result, the suggested system uses a maximum power point tracking method to collect DC electrical power from the solar module. Following DC power generation, it supplies a three-phase inverter. It transforms DC electricity into a three-phase AC supply, and then applies this three-phase AC power to an induction motor drive to generate the necessary torque and speed for a water pump to work.

3.1 Proposed System Configuration and Design

A. Design of the Solar PV Array

An induction motor rated at 3.8 kW is used for the suggested apparatus. The efficiency of the PV array will be higher than the output of the motor if engine and pump losses are disregarded. A 4.8 kW PV array is chosen in this case.

Where, P_{mp} = maximum power that the panels can produce at a particular radiation,

V_{mp} = PV panel voltage at MPP.

I_{mp} = current at MPP.

Ns = no. of module connected in series,

Np = no. of module connected in parallel.

Given that the grid's capacity is 4.8 kW and that the panel's open circuit voltage is comparable to a dc connection voltage, 15 and 1 modules in series and parallel, respectively, are chosen.

The details of each module are listed in Table 1.

Table 1 PV specification

Single module peak power-Pp	325 w
Open circuit voltage of module-voc	46.63 V
Short circuit current of module-isc	9.09 A
Voltage of module at MPP-vmp	38.06 V
Current of module at MPP-imp	8.54 A
Total peak power-Pmp	4.8k w
Total open circuit voltage–Voc	699.4 V
Total short circuit current-Isc	9.09 A
Total voltage at MPP-Vmp	570.9 V
Total Current at MPP-Imp	8.54 A

3.1.1 DC Link Voltage Selection

The following equation is used to get the dc link voltage:

$$\mathrm{m} \times \frac{Vdc}{ii2\sqrt{2}} = \frac{vl - l}{\sqrt{3}} \tag{1}$$

where *m*—modulation index

Vl-l—line voltage across the motor.

Hence,

$$V_{dc} = \frac{2\sqrt{2}}{\sqrt{3}} \times 230 = 375\,\mathrm{V}$$

modulation index = 1. The dc link voltage is selected at 400 V.

3.1.2 DC Link Capacitor Design

DC Link Capacitor value is calculated as

$$\frac{1}{2}\mathrm{Cdc}\left[\mathrm{Vdc}^{*2} - \mathrm{Vdc1}^{2}\right] = 3\alpha\mathrm{VIT} \tag{2}$$

$$\frac{1}{2}\mathrm{Cdc}\left[400^2 - 375^2\right] = 3 \times 1.2 \times 133 \times 8.2 \times 0.005$$

$$\mathrm{Cdc} = 2026\,\mathrm{uf} \tag{3}$$

α—overloading factor and t—transient time.

3.1.3 Design of the Pump

The proportionality constant of water pump.
K_{pump} is given by

$$\text{Kpump} = \frac{TL}{\omega r 2} \tag{4}$$

where, *TL*—load toque of water pump,

ωr—rotational speed of the rotor in rad/s.

Rated torque −14.69 N and Rated speed of the induction motor −1430 rpm.

K_{pump} = The proportionality constant is calculated by using (4).

$$\text{Kpump} = \frac{14.69}{\left(\frac{2\pi 1430}{60}\right)^2} = 6.55 \times 10^{-4}\,\text{Nm}/\left(\text{rad}/\text{s}\right)^2$$

4 Block Diagram

See Fig. 1.

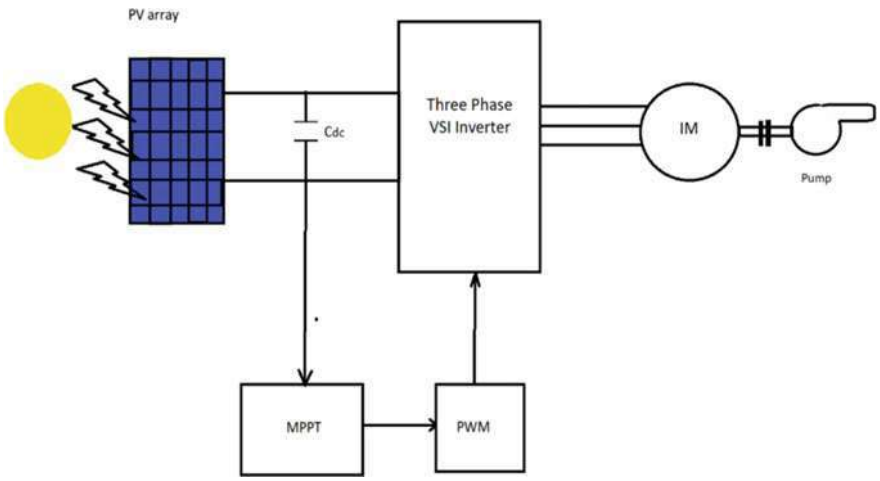


Fig. 1 Block diagram of proposed system

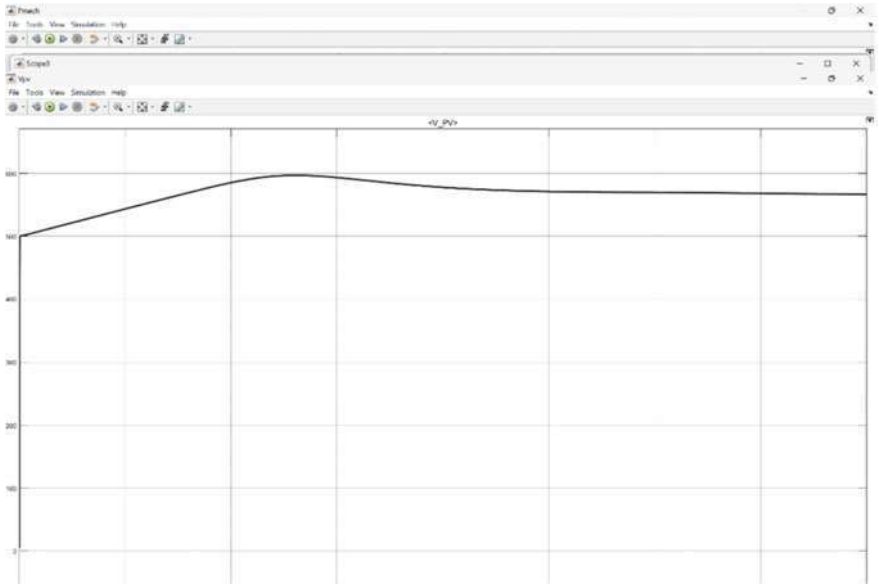


Fig. 2 PV voltage (Vpv) versus time (t)

5 Output

See Figs. 2, 3, 4, 5, 6, 7, 8 and 9.

6 Results and Discussion

This study creates an induction motor drive and MPPT controller-based water pumping system that is powered by solar energy. We used a 4.8 kW solar panel to provide a single input along with MPPT to IM, which then output the best results to the solar panel and supplied the same supply to the agriculture pumping motor. Based on the supply the 5HP motor performs, we created some graphs using 6 to 8 different parameters, including solar voltage, solar current, solar power, rotor angle, torque, Mechanical power, and speed. according to performance. We have shown that the system is stable within 3 s at 500 w/m^2 irradiation, making a significant contribution to the MPPT controller.

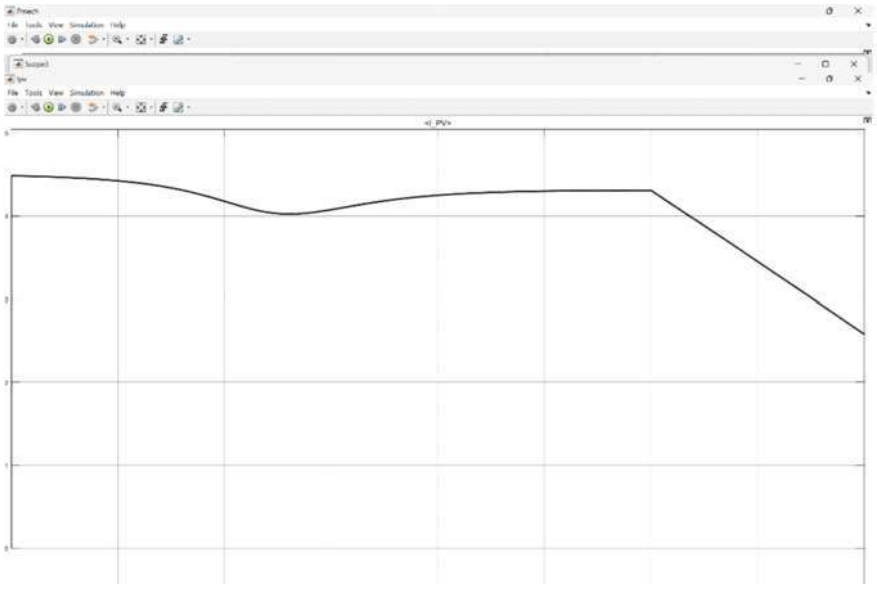


Fig. 3 PV current (Ipv) versus time (t)

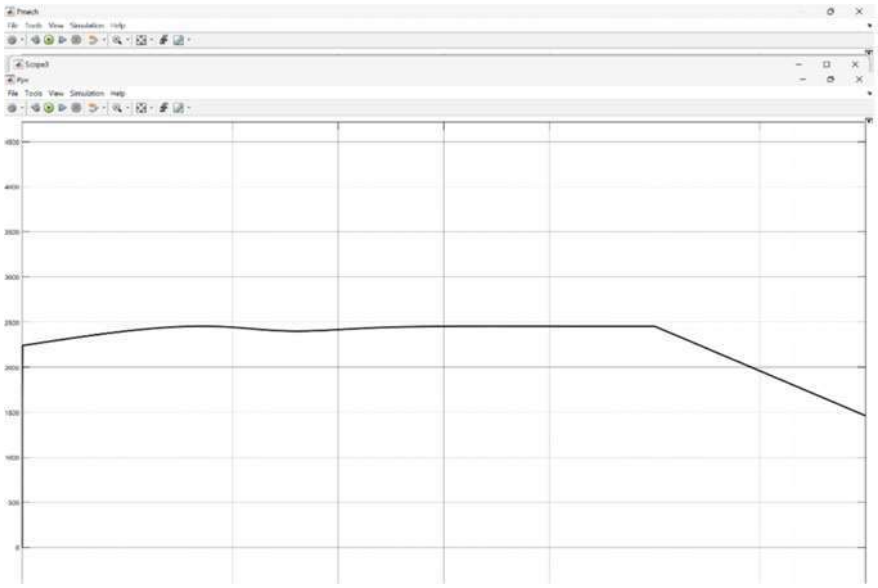


Fig. 4 PV power (P_{pv}) versus time (t)

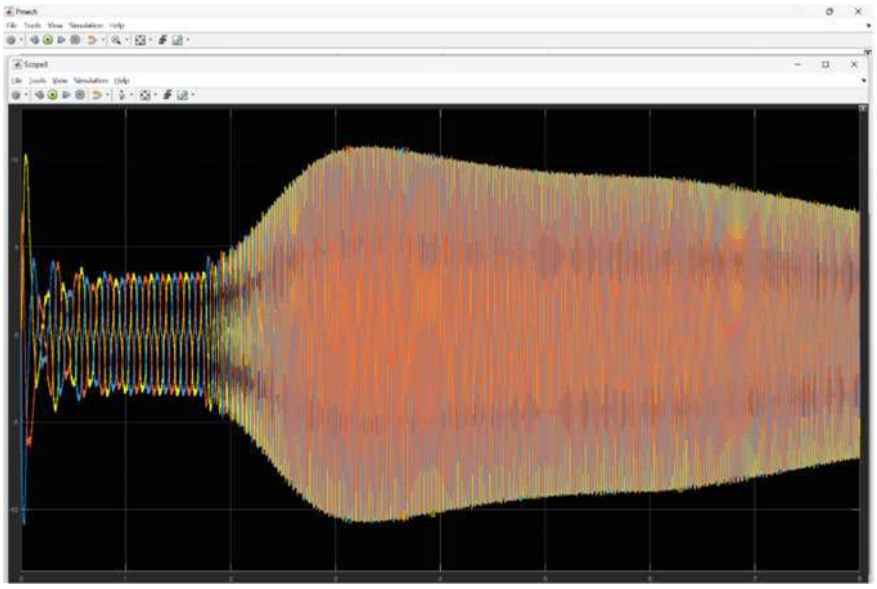


Fig. 5 Inverter output Ac current (Iac) versus time (t)

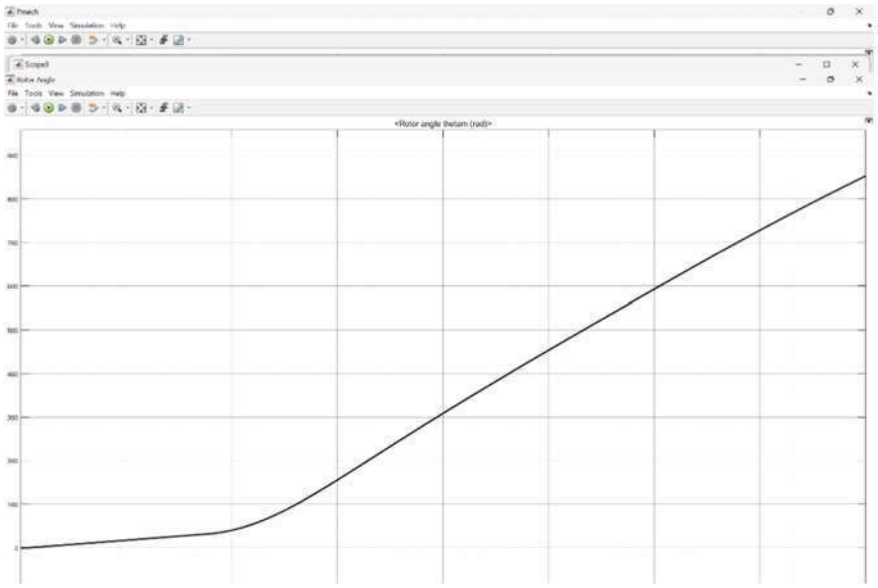


Fig. 6 Rotor angle versus time (t)

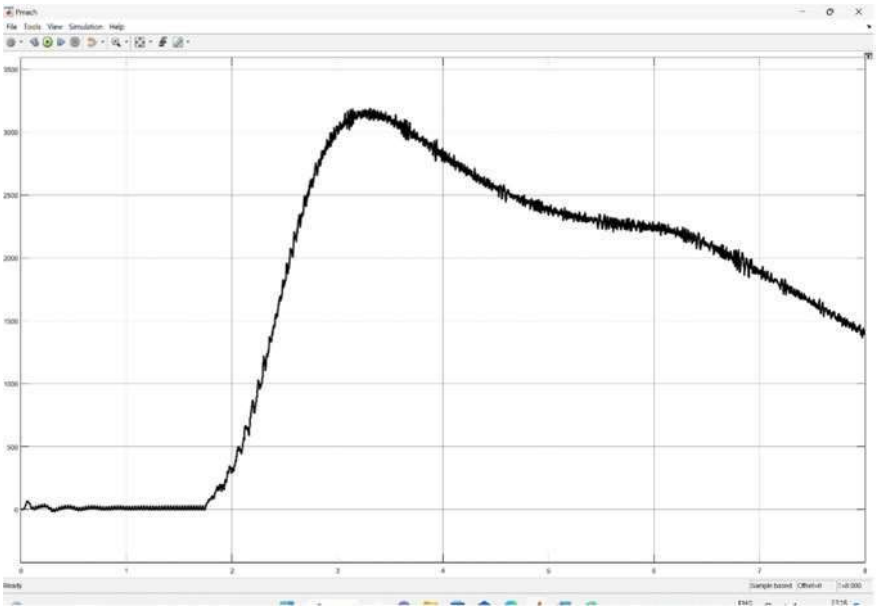


Fig. 7 Torque (Tm) versus time (t)

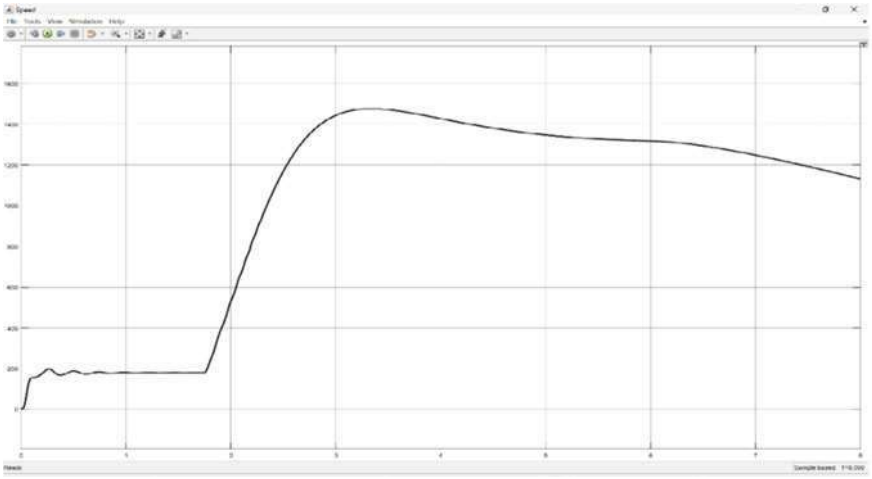


Fig. 8 Speed (N) versus time (t)

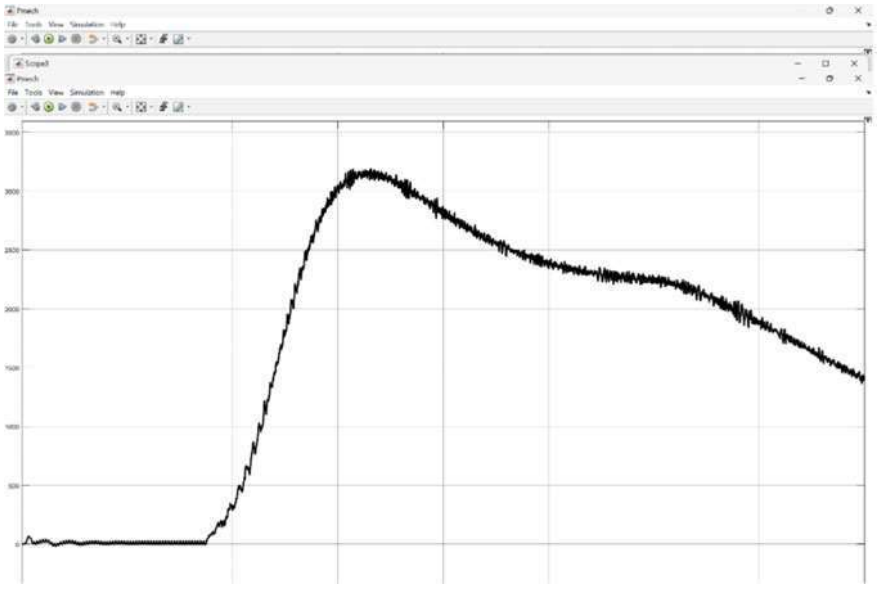


Fig. 9 Mechanical power (Pm) versus time (t)

The findings from the outputs for changing irradiations at different times were obtained as follows.

Data	PV rating	Motor rating	MPPT	Irradiations (w/m^2)	Time in sec	Vpv (volt)	Speed in RPM	Torque Nm	Pm in Watt
Ref. Paper [1]	2.4 kw	3 hp/ 2.4 kw	InC	500	8	400	1000	10	–
Proposed paper	4.8 kw	5 hp/ 3.8 kw	P&O	200	6	570	1100	12	1400
				500	3		1440	22	3200
				500	8	590	1130	11.83	1400

Based on a general study of the output graphs, it can be seen that the 5 hp induction motor drive and MPPT controller were successfully used to collect the most power possible from the solar panel, stabilize the results, and successfully stabilize the motor's torque and speed to pump water for irrigation.

7 Conclusion

A country's economy can prosper with the right infrastructure for generating renewable electricity. The idea proposes incorporating the solar water pumping technique into the agricultural irrigation system. A solar module would cut the price of a diesel engine system in half over its 25 year lifespan. We assess the relative value of various cost-cutting measures. It is recommended to use an independent solar water pump system with an induction motor drive. The P&O algorithm functions satisfactorily in the proposed system. Verification was possible by simulating the process in MATLAB. The MPP could be received by the apparatus with sufficient tolerance at varied radiation levels. The most power from a solar panel might be successfully acquired, stabilized, and managed by utilizing an induction motor drive with an MPPT controller.

References

1. Singh B, Sharma U, Kumar S (2018) Standalone Photovoltaic water pumping system using induction motor drive with reduced sensors. IEEE Trans Ind Appl 54(4)
2. Audenaert A, De Boeck L, De Cleyn S, Lizin S, Adam J-F (2010) An economic evaluation of Photovoltaic Grid Connected Systems (PVGCS) in flanders for companies: a generic model. Renew Energ 35:2674–2682
3. Vtas P, Pal Y (2017) Solar PV array buck-boost converter fed single phase induction motor drives for water pumping. In: IEEE international conference
4. Sharma U, Kumar S, Singh B (2016) Solar array fed water pumping system using induction motor drive. In: 2016 IEEE 1st international conference on power electronics, intelligent control and energy systems (ICPEICES). Delhi, pp 1–6
5. Shukla SS, Chandra A, Al-Haddad K (2016) Loss minimization of two stage solar powered speed sensor less vector controlled induction motor drive for water pumping. In: IECON 2016—42nd annual conference of the IEEE industrial electronics society. Florence, pp 1942–1947
6. Hohm DP, Ropp ME (2000) Comparative study of maximum power point tracking algorithms using an experimental, programmable, maximum power. IEEE, pp 1699–1702
7. Subudhi B, Pradhan R (2013) A comparative study on maximum power point tracking techniques for photovoltaic power systems. IEEE Trans Sustain Energy 4(1):89–98
8. Gupta S, Rajaji L, Kalika S (2012) Designing and implementation of MPPT controller for varying radiance in solar PV system. In: IET Chennai 3rd international conference on sustainable energy and intelligent systems (SEISCON 2012)
9. Singh B, Sharma U (2017) Three phase grid interfaced solar water pumping system. In: 2017 National power electronics conference
10. Mohan N, Undeland T, Robbins W (2009) Power electronics: converters, applications and design, 3. Wiley, New Delhi, India
11. https://en.wikipedia.org/wiki/MPPT
12. https://en.wikipedia.org/wiki/Solar panel
13. https://en.wikipedia.org/wiki/Induction motor drive

WELCOME to ICRERA 2023

Dear Colleagues,

The purpose of the International Conference on Renewable Energy Research and Applications (ICRERA) 2023 is to bring together researchers, engineers, manufacturers, practitioners and customers from all over the world to share and discuss advances and developments in renewable energy research and applications.

After the successes of the first, the second, the third, the fourth, the fifth , the sixth, the seventh, the eighth, the ninth, the tenth, and the eleventh editions of ICRERA in Nagasaki (2012), Madrid (2013), Milwaukee (2014), Palermo (2015), Birmingham (2016), San Diego (2017), Paris (2018), Brasov (2019), Glasgow (2020), Istanbul(2021), Istanbul(2022), the 12th ICRERA 2023 is going to be organized by the technical co-sponsorship of IEEE IES and IAS in Oshawa, Canada on August 29 – September 1, 2023. Attending ICRERA 2023 will benefit you to meet well-known expert keynote speakers, tutorial organizers, special session organizers as well as young and many other colleagues coming from more than 60 countries.

It is our happiness to share with you that selected 100 papers at ICRERA2022 have been proposed for possible publications in

- IEEE Transactions on Industrial Applications (15 papers) cited in SCI-Expended,
- International Journal of Renewable Energy Research (15 Papers) cited in ESCI,
- International Journal of Smart Grid (20 papers) cited in Google Scholar,
- International Journal of Engineering Science and Applications (14 papers),

and

- Electric Power Components and Systems (36 papers) cited in SCI-Expended.

Up to 2023, all papers presented ICRERA have been cited in IEEE Xplore, SCOPUS and Web of Science (Clarivate Analytics).

According to WEB of Science (Clarivate Analytics) in 2023;

h-index = 24

Average citation per item = 4.3

5 Years Impact Factor = 12.35

ICRERA aims to present important results to the international renewable energy community in the form of research, development, applications, design, and technology. It is therefore intended to assist researchers, scientists, manufacturers, companies, communities, agencies, associations and societies to keep abreast on new developments in their specialties and to unite in finding alternative energy solutions to current issues such as the greenhouse effect, sustainable and clean energy issues.

Professor Sheldon Williamson,
General Chair, ICRERA 2023

Professor Adel Nasiri,
Co-Chair, ICRERA 2023

Professor Ilhami COLAK,
Co-Chair, ICRERA 2023

Professor Fujio KUROKAWA,
Co-Chair, ICRERA 2023

2023 12th International Conference on Renewable Energy Research and Applications (ICRERA) | 979-8-3503-3793-8/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICRERA59003.2023.10269434

Integration of Electric Vehicles, Renewable Energy Sources, and IoT for Sustainable Transportation and Energy Management: A Comprehensive Review and Future Prospects

N. V. A. Ravikumar[1]
Department of Electrical and Electronics Engineering, GMR Institute of Technology, Rajam
Polamarasetty P Kumar[2]
Department of Electrical and Electronics Engineering, GMR Institute of Technology, Rajam
Dr. Umakant Dinkar Butkar[5]
[5]Computer Engineering College - Guru Gobind Singh College of Engineering and Research center, Nashik
Country- India

Ramakrishna S S Nuvvula[2]
Department of Electrical and Electronics Engineering, GMR Institute of Technology, Rajam
Noor Hanoon Haroon[4]
[4]Department of Computer Technical Engineering, Technical Engineering College, Al-Ayen University, Thi-Qar, Iraq.
Alighazi Siddiqui[6]
Computer Science Department College of Computer Science and Information Technology
,Jazan University COLLEGE LOCATED CITY NAME: Jazan, Saudi Arabia

***Abstract*— As the world fights climate change and depletes fossil fuel reserves, EVs, RES, and IoT offer sustainable transportation and energy management. This research paper examines the technological advances, regulatory initiatives, and market trends that have brought these three sectors together. EVs can reduce carbon footprints, energy efficiency, and urban pollution, but the article discusses their pros and cons in transportation. Batteries, charging infrastructure, and vehicle-to-grid (V2G) capabilities are essential to integrating EVs into the power grid and realizing their full potential as distributed energy resources. The article also discusses how electric vehicles and renewable energy are growing in the electricity industry. Clean and sustainable energy mixes include solar, wind, hydro, and biomass. Demand response and energy storage can help integrate RES smoothly into the grid, according to the article.**

The study explores how IoT can change electric vehicles, renewable energy, and the power grid. Smart charging stations, V2I connectivity, and intelligent energy management systems could change energy consumption and distribution. IoT-enabled real-time data analytics and automation for EV charging, dynamic load balancing, and grid stability improve energy management and carbon footprint. This study examines the prospects and challenges of sustainable transportation and energy management with EVs, RES, and the Internet of Things. This includes uniform communication protocols, intermittent renewable energy, and strict cybersecurity .The report concludes with future research. The paper encourages policymakers, industry stakeholders, and academics to collaborate on new business models, policy frameworks, and technological advances to accelerate this integrated approach's adoption.

Keywords: Sustainable transportation, Energy management, Distributed energy resources, Carbon footprint reduction

Introduction (*Heading 1*)

1. INTRODUCTION:

Transitioning to sustainable energy and transportation systems is a global priority in light of the urgent threats posed by climate change and the depletion of finite fossil fuel stocks. Greenhouse gas emissions can be greatly reduced, energy efficiency can be improved, and sustainable transportation and energy management can be attained through the convergence of electric vehicles (EVs), renewable energy sources (RES), and the Internet of Things (IoT). This study examines the potential for developing a cleaner and more resilient energy environment by reviewing the current state of the art in the convergence of these three fields.

A. Background and Motivation

About fourteen percent of the world's total emissions in 2019 [1] came from the transportation sector, making it the single largest contributor to greenhouse gas emissions. It has been suggested that widespread use of electric mobility could help reduce these emissions. Rechargeable battery-powered electric vehicles (EVs) have the potential to displace those driven by traditional internal combustion engines, thereby lowering emissions and the environmental impact of transportation.

Meanwhile, renewable energy sources have matured into a competitive and long-term replacement for conventional fossil fuels. Among the most well-known renewable resources that use natural processes to generate clean electricity are solar, wind, hydro, and biomass. Widespread adoption of these technologies has been spurred by their decreasing prices and rising efficiency, opening the door to decarbonizing the power sector and aiding in the achievement of global climate targets.

B. Synergy of Electric Vehicles, Renewable Energy, and IoT

The Internet of Things (IoT), renewable energy sources (RES), and electric vehicles (EVs) have come together in

2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) | 979-8-3503-9926-4/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICACITE57410.2023.10182898

2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)

12-13th May 2023

Department of Electrical & Electronics Engineering

Galgotias College of Engineering and Technology, Greater Noida, India

Organized by:

Technically Co-Sponsored by:

IEEE UP Section

2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) | 979-8-3503-9926-4/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICACITE57410.2023.10182898

Internet Traffic Dynamics in Wireless Sensor Networks

Akash Kumar Bhaga
Assistant Professor
Department of Computer Science
ARKA JAIN Universiy
Jamshedpur, Jharkhand, India
akash.b@arkajainuniversity.ac.in

Gadug Sudhamsu
Assistant Professor
Department of Computer Science and Engineering
JAIN(Deemed-to-be University)
s.gadug@jainuniversity.ac.in

Sachin Sharma
Assistant professor
Department of Computer Sciece and Engineering
Dev Bhoomi Uttarakhand University
Dehradun, Uttarakhand, India
socse.sachin@dbuu.ac.in

Imad Saeed Abdulrahman
College of Technical Engineering
Al-Farahidi University
Baghdad, Iraq
Imad.Abdulrahman@uoalfarahidi.edu.iq

Ramchandra Nittala
Department of Electrical and Electronics Engineering
St. Martin's Engineering College
nittala1988@gmail.com

Dr. Umakant Dinkar Butkar
Assistant Professor
Department of Computer Engineering
Sir visvesvaraya Institute of Technology
Nashik, India
vishal.butkar@gmail.com

Abstract: -Transportation by vehicle is becoming more and more important everywhere, particularly in large urban areas. The continual technological advancements that support vehicle mobility, such as controlled electrical, inductive rings, monitoring cameras, and so forth, are expensive and in addition demand significant maintenance costs. Moreover, the accuracy of these devices is also dependent on the weather. The standard usual approaches aim to simplify signalized intersections operation for a certain traffic arrangement and thicknesses. In any event, a major barrier to using these tactics is the difficulty of consistently displaying the effective behaviour of changing configurations and traffic volumes. By many accounts, traffic is more of a transition than an improvement problem. In order to address the aforementioned problem, we offer a method in this study that performs flexible signal timing management using a setup of a distant sensor nodes. The goal of the study is to investigate methods for creating a developing this system that can integrate and enable some of the most recent traffic signal technologies and, as a result, reduce the amount of time that cars are typically stopped at a junction. The suggested algorithms can adapt to the traffic flow at any intersection of streets. To construct a graph of typical noise levels versus cycles, transportation incidents from real life are acted out in the Green Arrow District Sim, a stage that has been faithfully replicated. The results obtained demonstrate the viability of the suggested method for the stop light at a real street cross location.

Keywords: -Internet Traffic Dynamics, Wireless Sensor Network (WSN), Internet of Thing (IoT)

I. INTRODUCTION

Ascend in traffic, are influencing numerous people in time, energy and persistence on streets. Indeed, even in the wake of further developing the current street foundation, In only certain situations, the normal wait time for a car at a crosswalk can seem eternal. The most recent technological developments that assist automotive movement, such as making special, induction circle, spy cameras, and other devices that may detect a car in a good location, are expensive and demand significant maintenance costs. Also, the accuracy of these devices depends on the weather, and the signal timing management system necessitates designs which can adapt to constantly shifting traffic volumes and patterns. Wireless sensors networks provide the solution in such recurring circumstances and fundamental uses. WSNs have shown to be the most effective at addressing traffic challenges because they're extremely versatile, robust, and work brilliantly for app locations that need little power, little expenditure, and easy maintenance.

Because of recent developments in circuit boards, network management, and data processing, the wireless sensor network has become an intriguing innovation. Uses like front paragraph analysis and foe having followed initially influenced the WSN investigations. Presently, numerous common utilizations of WSN have additionally been proposed, which incorporatenatural surroundings checking, Software packages for environment sensing and anticipation, health monitoring, etc. Many uses include the grouping of a large number of low-cost, low-power remote sensor across a broad region.

It is acknowledged that connectivity in WSNs outweighs energy use [1]. Calculating and recognizing need less effort. When using a generally usable processor, the energy required to convey 1 Kb across a length of 100 metres is about similar to that required to execute 2.5 million recommendations [2]. Hence, controlling communication-related energy usage is crucial for reducing the electricity need in WSNs.

In particular with respect to traffic aspects and interaction designs, the knowledge currently available on communications in WSNs is still fragmentary & ambiguous. Obviously, knowledge of the traffic characteristics and conversation instances may aid in understanding how energy is used and circulated in WSNs. In this way, the investigation of traffic characteristics and methods of communication serves as a good starting point for the search for WSNs that are more power. The idea of WSNs to simplify energy use will be feasible as a result of these creative approaches that are being proposed.

Paper Sr. No - 81

Sustainable Science and Intelligent Technologies for Societal Development

Brojo Kishore Mishra
NIST Institute of Science and Technology (Autonomous), India

IGI Global
PUBLISHER of TIMELY KNOWLEDGE

A volume in the Practice, Progress, and Proficiency in Sustainability (PPPS) Book Series

Chapter 3
Annotations of Machine Learning in Communication and Identification Systems Pertaining to Security Aspects:
ML Applications in Security and Identity

Dillip Rout
https://orcid.org/0000-0001-6928-2737
Sandip University, India

Swati Gawand
Sandip University, India

Jayashree Mahale
Sandip University, India

Joseph Wheeder
Sandip University, India

ABSTRACT

In this work, a summary of machine learning (ML) applications in communication and identification technologies is presented. Focus is placed in particular on device communication over the Internet. In other words, the topic of device communication between computers, cell phones, and other electronic devices is covered. Additionally, the internet of things (IoT) technologies used to connect smart gadgets are detailed. Along with describing the methods of data sharing, the security characteristics of these communications are also discussed. In essence, ML algorithms are discussed to represent strategies to improve security. Furthermore, the identification of passengers and vehicles is explained, taking communication technologies like the internet, wireless fidelity (WiFi), radio frequency identification (RFID), etc. In this context, particular algorithms are discussed together with their benefits and drawbacks. The ML algorithms are found to be extremely helpful in these areas.

DOI: 10.4018/979-8-3693-1186-8.ch003